Biochemistry

Questions

MOLECULAR

1. Which histone is not part of the nucleosome? *(p 34)* _____
2. What is DNA called when it is condensed and transcriptionally inactive? *(p 34)* _____
3. What is the name for less condensed, transcriptionally active DNA? *(p 34)* _____
4. What effect does greater G-C content have on the melting temperature of DNA? *(p 35)* _____

   _____
5. Which enzyme is inhibited by hydroxyurea? *(p 36)* _____
6. 5-fluorouracil inhibits _____, whereas both methotrexate and trimethoprim inhibit _____. *(p 36)*
7. A 12-year-old boy with moderate intellectual disability visits his physician because of a painful and swollen left big toe. During the examination, the boy makes several uncontrolled spastic muscle movements. When he was 3 years old, he was referred to a pediatric dentist for severe repetitive biting of his lip and tongue. He also has a history of being aggressive towards family members and classmates. What is the most likely diagnosis? *(p 37)* _____

   _____

   _____

   _____
8. What enzyme “proofreads” DNA synthesis with its exonuclease activity in prokaryotic DNA replication? In which direction does this enzyme remove nucleotides? *(p 38)* _____

   _____

9. What enzyme degrades the RNA primer and replaces it with DNA during prokaryotic DNA replication? *(p 38)* _____

10. Which category of drugs inhibits DNA gyrase? *(p 38)* _____

11. Silent mutations often result from changes in which position of a codon? *(p 39)* _____

12. β-Thalassemia can be caused by a mutation in _____, which is a process that combines exons to produce larger, unique genes, and allows the same gene to encode for various different proteins. *(p 39)*

13. What kind of mutation denotes a DNA change that results in the misreading of all nucleotides downstream from it? *(p 39)* _____

14. What specific DNA repair mechanism is defective in xeroderma pigmentosum? *(p 40)* _____

_____

15. In single-stranded DNA repair, how are nucleotide excision repair and base excision repair different? *(p 40)* _____

_____

16. Hereditary nonpolyposis colorectal cancer results from the loss of which DNA repair mechanism? *(p 40)* _____

17. What commonly results from a mutation within a promoter? *(p 41)* _____

18. What type of RNA is the largest? The smallest? The most rampant? *(p 42)* _____

_____

19. What poisonous protein that inhibits RNA polymerase II is found in death cap mushrooms? *(p 42)*

_____

20. In eukaryotes, what enzyme makes mRNA? *(p 42)* _____

21. In eukaryotes, what enzyme makes tRNA? *(p 42)* _____

22. Explain the three steps of the elongation phase of protein synthesis. *(p 45)* _____

_____

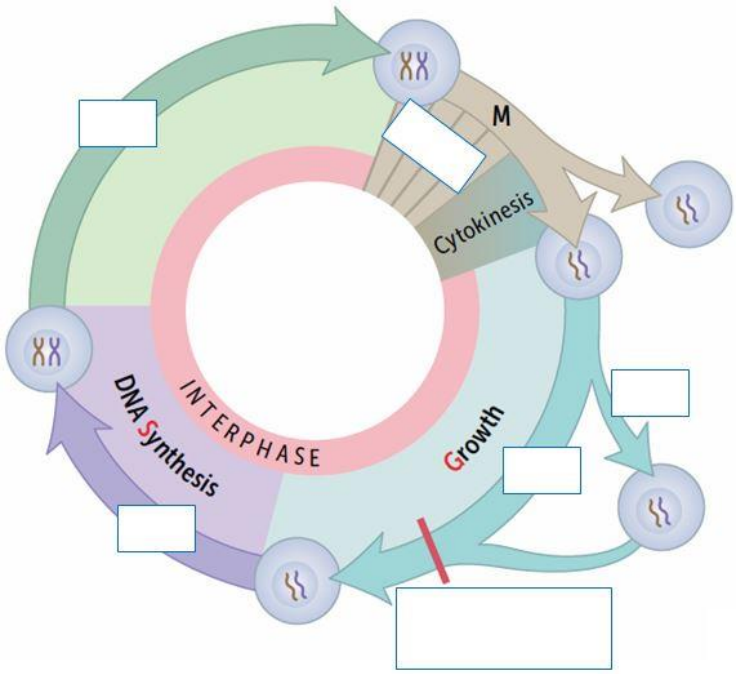
_____

23. What category of proteins, eg, HSP60 facilitates and maintains protein folding? *(p 45)*

_____

CELLULAR

24. Fill in the boxes on the following diagram, noting the phases of the mitotic cell cycle. *(p 46)*



25. Which transition in the cell cycle is prevented by *Rb* and *p53* tumor suppressors? *(p 46)* _____

_____

26. Match the cell type with its description. *(p 46)*

_____ A.	Remain in G_0 and regenerate from stem cells	1. Labile cells
_____ B.	Enter G_1 from G_0 when stimulated	2. Permanent cells
_____ C.	Never go to G_0 and divide rapidly with a short G_1	3. Stable (quiescent) cells

27. Name two cells that are rich in the rough endoplasmic reticulum. *(p 46)* _____

_____

28. Name two cells that are rich in the smooth endoplasmic reticulum. *(p 46)* _____

_____

29. A child presents with coarse facial features, clouded corneas, restricted joint movement, and high plasma levels of lysosomal enzymes. What is the most likely diagnosis? *(p 47)* _____

30. Which molecular motor protein is used for anterograde transport along microtubules? *(p 48)* _____

_____

31. Which antifungal drug targets microtubules? *(p 48)* _____

32. Which antihelminthic drug targets microtubules? *(p 48)* _____

33. Cilia, flagella, mitotic spindle, axonal trafficking, and centrioles are examples of which type of cytoskeletal element? *(p 48)* _____

34. Vimentin, desmin, cytokeratin, lamins, glial fibrillary acid protein (GFAP), and neurofilaments are examples of which type of cytoskeletal element? *(p 48)* _____

35. A 22-year-old woman presents with a history of recurrent sinusitis. X-ray of the chest shows dextrocardia. What is the most likely diagnosis? *(p 49)* _____

36. What effect does digoxin's inhibition of Na^+-K^+ ATPase have on cardiac contractility? *(p 49)* _____

_____

37. What type of collagen is found in each structure? *(p 50)*

_____ A. Basement membrane (basal lamina), lens

_____ B. Bone, skin, tendon, dentin, fascia, cornea, late wound repair

_____ C. Cartilage, vitreous body, nucleus pulposus

_____ D. Reticulin—skin, blood vessels, uterus, fetal tissue, early wound repair

1. Type I collagen
2. Type II collagen
3. Type III collagen
4. Type IV collagen

38. British sailors in the 17th century were often unable to hydroxylate proline and lysine residues for collagen synthesis, and drank lime juice to treat the condition. What disease did they have, and why did the treatment work? *(p 50)* _____

_____

39. What disease leads to an inability to form procollagen and the triple helix alpha chain? *(p 51)* ____

_____

40. A baby is born with multiple fractures and hearing loss. What finding would most likely be seen during the ophthalmologic examination? *(p 51)* _____

41. A patient presents with hyperextensible skin, easy bruising, and hypermobile joints. What is the most likely diagnosis? *(p 51)* _____

42. Which enzyme involved in collagen synthesis will have decreased activity in a patient who has a mutation that impairs copper absorption and transport? *(p 51)* _____

43. Marfan syndrome is caused by a defect in what glycoprotein? *(p 52)* _____

44. Which lung disorder can result from unopposed elastase activity? *(p 52)* _____

LABORATORY TECHNIQUES

45. Which reaction uses reverse transcription to create a complementary DNA template that is amplified via the standard PCR procedure? *(p 52)* _____

46. Which endonuclease can be used with a guide RNA sequence to edit genomes? *(p 53)* _____

_____

47. Describe each of the following blot techniques: Southern, Northern, and Western. *(p 53)*

Southern blot: _____

_____

Northern blot: _____

_____

Western blot: _____

_____

48. Which laboratory technique can assess size, granularity, and immunophenotype of individual cells in a sample? *(p 54)* _____

49. Which assay can measure the expression level of thousands of genes simultaneously? *(p 54)* ____

_____

50. What is the advantage of a Western blot over an enzyme-linked immunosorbent assay (ELISA)? *(p 54)* _____

51. What is the advantage of fluorescence in situ hybridization over karyotyping? *(p 55)* _____

_____

52. What is the most direct lab technique for detecting autosomal trisomies? *(p 55)* _____

_____

53. Abnormal expression of _____ contributes to certain malignancies. *(p 56)*

GENETICS

54. What does a mutant genotype that causes a disease phenotype in some individuals but not in others exhibit? *(p 56)* _____

55. Explain loss of heterozygosity. *(p 56)* _____

_____

56. A genetic disease that shows _____ may have mutations at one of several different loci that produce a similar phenotype. *(p 57)*

57. In terms of p and q, what is the frequency of heterozygosity in a population that is in Hardy-Weinberg equilibrium? *(p 57)* _____

58. What is the difference between lyonization and mosaicism? *(pp 57, 61)* _____

_____

_____

59. How is Prader-Willi syndrome inherited? What are the symptoms? *(p 58)* _____

_____

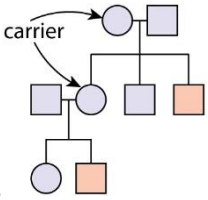
_____

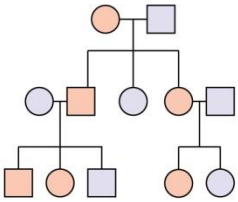
60. How is Angelman syndrome inherited? What are the symptoms? *(p 58)* _____

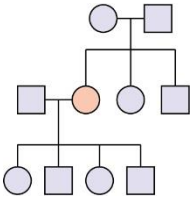
_____

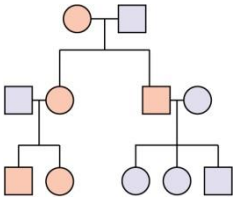
_____

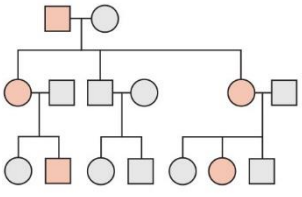
61. Which mode of inheritance is represented by each of the following pedigrees? *(p 59)*

_____ A. 

_____ B. 

_____ C. 

_____ D. 

_____ E. 

1. Autosomal dominant
2. Autosomal recessive
3. Mitochondrial inheritance
4. X-linked dominant
5. X-linked recessive

62. What percentage of sons of a carrier mother is expected to inherit an X-linked recessive disease? *(p 59)* _____

63. True or False: A mother with an X-linked dominant disease may pass the disease to her sons but not to her daughters. *(p 59)* _____

64. Are most of the mucopolysaccharidoses and sphingolipidoses autosomal recessive or autosomal dominant? What are the exceptions? *(p 60)* _____

_____

65. Cystic fibrosis results from a defect in which gene? Which chromosome? Which ion channel? *(p 60)* _____

66. Which drug(s) can be used to loosen mucus plugs in patients with cystic fibrosis? *(p 60)* _____

_____

67. A patient with cystic fibrosis has an increased risk of which vitamin deficiencies? *(p 60)*

_____

68. What is the genetic etiology of myotonic type 1 muscular dystrophy? *(p 61)* _____

_____

69. A 4-year-old boy needs to use his upper extremities to push against his legs in order to stand up. What maneuver is he using? *(p 61)* _____

70. A 2-year-old girl presents with seizures, regression in verbal and cognitive abilities, and hand-wringing movements. She is diagnosed with a disease caused by a mutation on the X chromosome. What is the disease, and the associated gene? *(p 62)* _____

_____

71. A male patient has a long face, a large jaw, large ears, autism, and macroorchidism. What is the most likely diagnosis? *(p 62)* _____

72. Before his anticipated death, a 42-year-old man had received many years of treatment for depression, severe cognitive decline, and involuntary writhing movements. His father had similar symptoms shortly before his death. What is the cause of this patient's most likely disease? *(pp 62, 64)* _____

73. A newborn is diagnosed with Down syndrome. She is vomiting bilious material. What is the most likely cause? *(p 63)* _____

74. The *BRCA1* and *BRCA2* genes are on which chromosome(s)? *(p 64)* _____

_____

NUTRITION

75. Match each set of symptoms/conditions with the vitamin that is deficient. *(pp 66-71)*

_____ A.	Bruising, anemia, swollen gums, and poor wound healing	1. Vitamin A
_____ B.	Cheilosis and corneal vascularization	2. Vitamin B_1
_____ C.	Convulsions, hyperirritability, peripheral neuropathy, and sideroblastic anemia	3. Vitamin B_2 4. Vitamin B_3
_____ D.	Dermatitis, enteritis, and alopecia	5. Vitamin B_5
_____ E.	Dermatitis, enteritis, alopecia, and adrenal insufficiency	6. Vitamin B_6
_____ F.	Diarrhea, dermatitis, and dementia (pellagra)	7. Vitamin B_7
_____ G.	Hemolytic anemia, muscle weakness, and acanthocytosis	8. Vitamin B_9
_____ H.	Neonatal hemorrhage	9. Vitamin B_{12}
_____ I.	Hypocalcemic tetany, rickets, osteomalacia	10. Vitamin C
_____ J.	Macrocytic, megaloblastic anemia, glossitis, no neurologic symptoms	11. Vitamin D 12. Vitamin E
_____ K.	Macrocytic, megaloblastic anemia, subacute combined degeneration, and paresthesias	13. Vitamin K
_____ L.	Night blindness, dry, scaly skin	
_____ M.	Wernicke-Korsakoff syndrome	

76. Which vitamin or mineral is a cofactor for over one hundred enzymes, and has dysgeusia as a symptom of its deficiency? *(p 71)* _____

77. What is the primary feature of kwashiorkor that distinguishes it from marasmus? *(p 71)* _____

_____

78. Does ethanol metabolism by hepatocytes produce or consume NADH? *(p 72)* _____

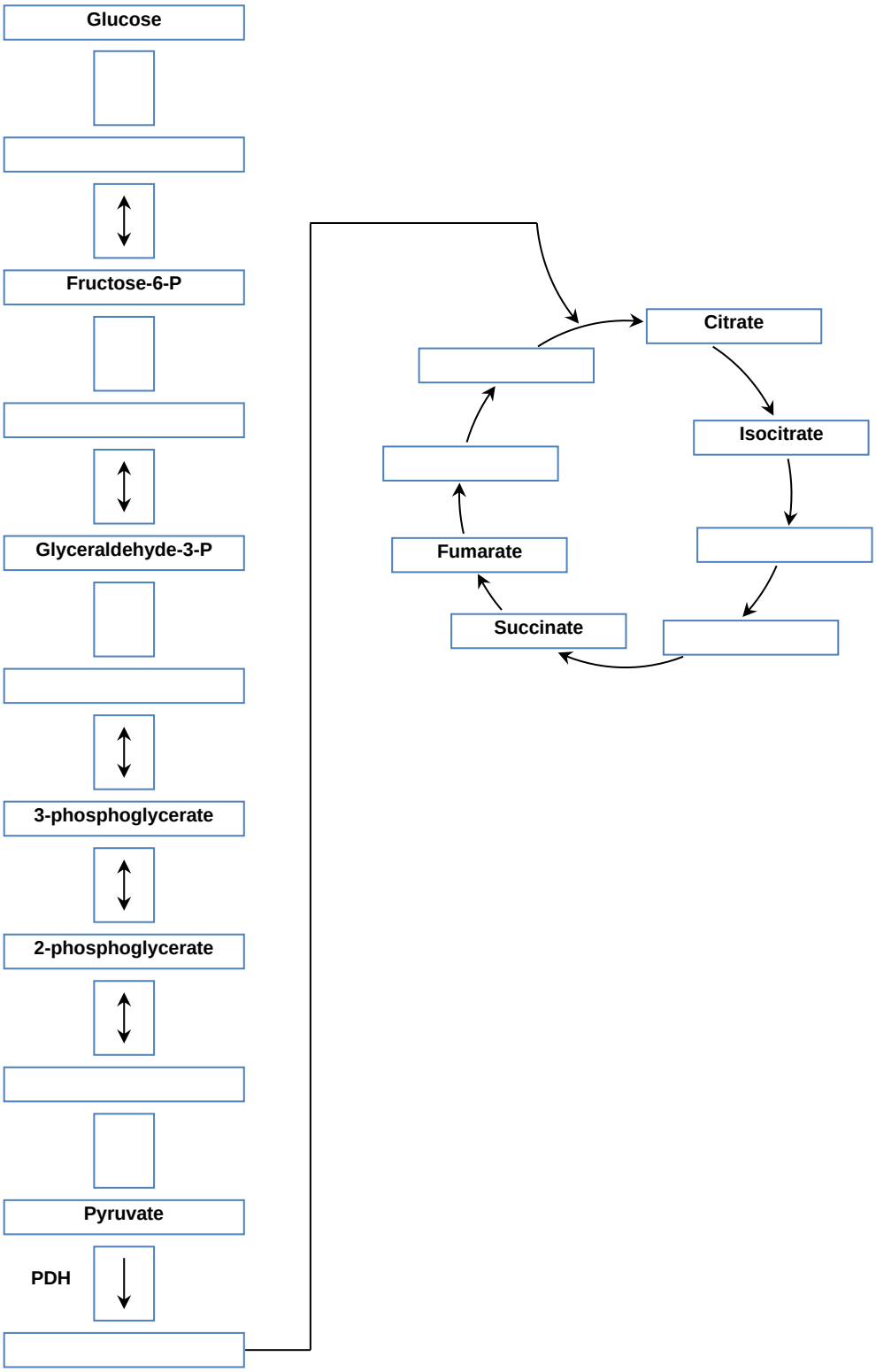
_____

METABOLISM

79. Match each of the following processes with its rate-determining enzyme. *(p 73)*

_____ A. Cholesterol synthesis	1. Acetyl-CoA carboxylase (ACC)
_____ B. De novo purine synthesis	2. Carbamoyl phosphate synthetase I
_____ C. De novo pyrimidine synthesis	3. Carbamoyl phosphate synthetase II
_____ D. Fatty acid oxidation	4. Carnitine acyltransferase I
_____ E. Fatty acid synthesis	5. Fructose-1,6-bisphosphatase
_____ F. Glycogenesis	6. Glucose-6-phosphate dehydrogenase
_____ G. Glycolysis	7. Glutamine-PRPP amidotransferase
_____ H. Gluconeogenesis	8. Glycogen phosphorylase
_____ I. Glycogenolysis	9. Glycogen synthase
_____ J. HMP shunt	10. HMG-CoA reductase
_____ K. Ketogenesis	11. HMG-CoA synthase
_____ L. TCA cycle	12. Isocitrate dehydrogenase
_____ M. Urea cycle	13. Phosphofructokinase-1 (PFK-1)

80. In the following diagram, fill in the rectangles with the intermediates and products. Which steps of glycolysis are reversible? (Add one- or two-sided arrows to the squares.) *(p 74)*



81. How many ATP molecules can be created by the aerobic and anaerobic metabolism of glucose? *(p 74)* _____

_____

82. The α-ketoglutarate dehydrogenase complex and the pyruvate dehydrogenase complex require the same five cofactors. What are these cofactors? *(p 76)* _____

_____

83. List the four irreversible enzymes in gluconeogenesis. *(p 78)* _____

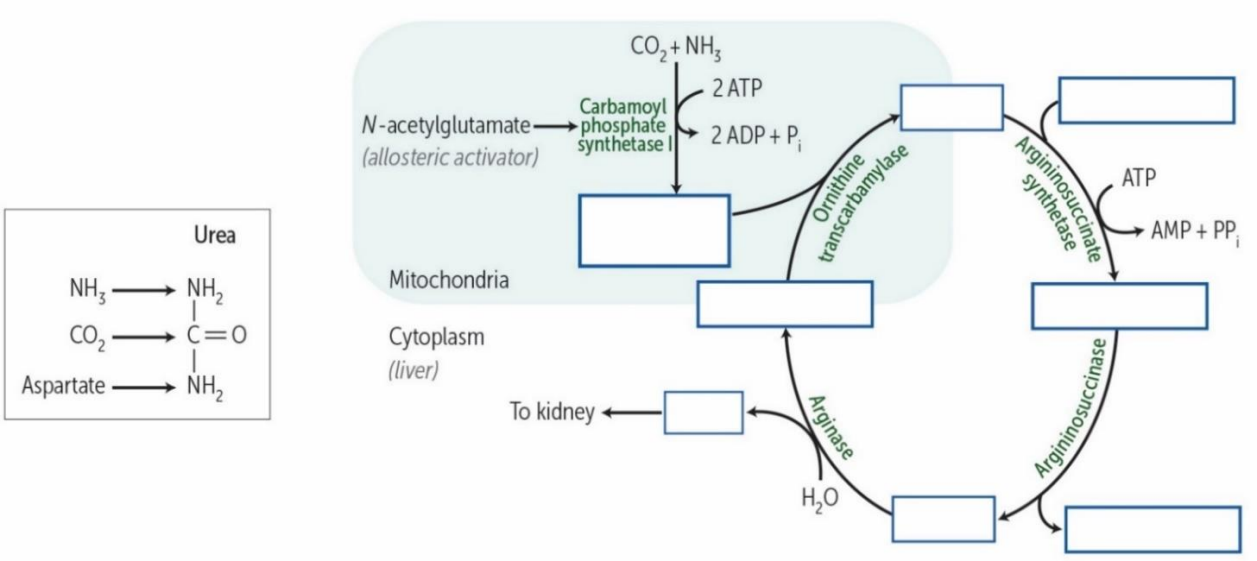
_____

84. What are Heinz bodies? What are bite cells? *(p 79)* _____

_____

_____

85. Fill in the boxes in the diagram below, noting the substrates of the urea cycle. *(p 82)*

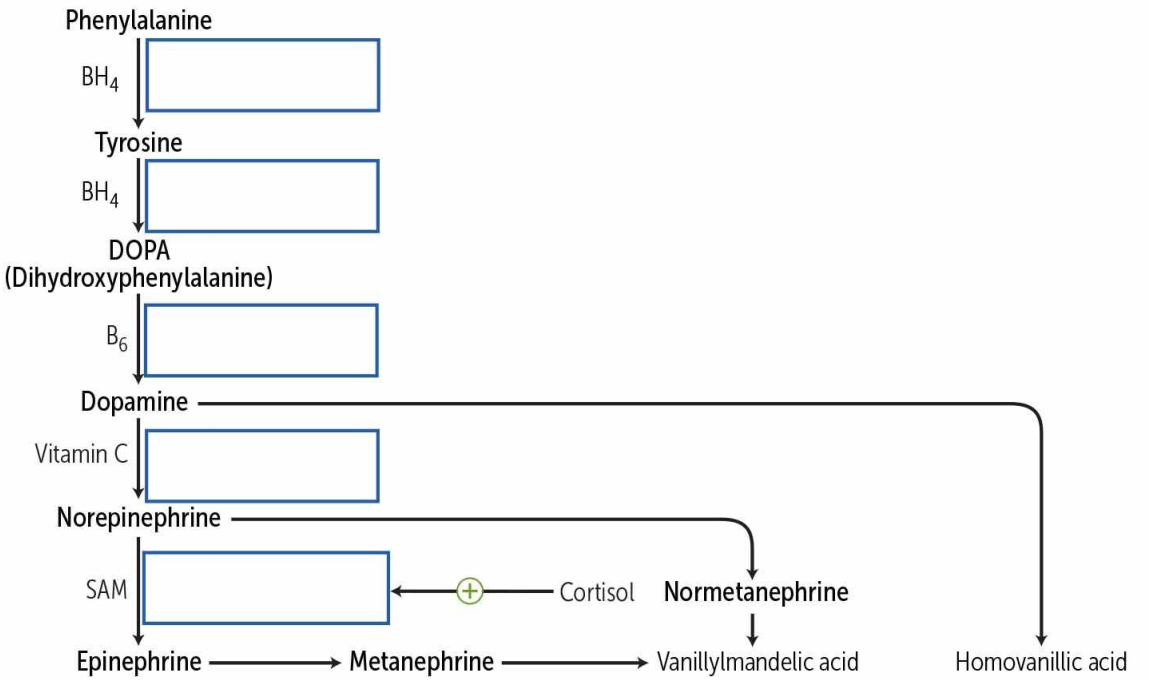


86. A two-day-old male infant is irritable and lethargic. Serum studies show increased orotic acid and hyperammonemia, with a normal hematocrit and MCV. What is the most likely diagnosis? *(p 83)*

_____

_____

87. Fill in the boxes in the following diagram, noting the enzymes that catalyze each step of catecholamine synthesis. *(p 83)*



88. What is the treatment for propionic acidemia? *(p 85)* _____

_____

89. A 16-year-old boy presents for a routine visit. Physical examination shows symptoms consistent with Fabry disease. What is the inheritance pattern of this disease? *(p 88)* _____

_____

90. Using the list below, name the deficient enzyme and accumulated substrate(s) for each lysosomal storage disease listed in the chart below. (Some answers may be used more than once.) *(p 88)*

α-galactosidase A	Dermatan sulfate	Hexosaminidase A
α-L-iduronidase	Galactocerebrosidase	Iduronate-2-sulfatase
Arylsulfatase A	Galactocerebroside	Psychosine
β-glucocerebrosidase	Glucocerebroside	Sphingomyelin
Ceramide trihexoside	GM_2 ganglioside	Sphingomyelinase
Cerebroside sulfate	Heparan sulfate	

Disease	Deficient Enzyme	Accumulated Substrate
Fabry disease		
Gaucher disease		
Hunter syndrome		
Hurler syndrome		
Krabbe disease		
Metachromatic leukodystrophy		
Niemann-Pick disease		
Tay-Sachs disease		

91. Which cell type(s) cannot use ketones as an energy source? Why? *(p 91)* _____

_____

92. Which enzyme degrades triglycerides stored in adipocytes? *(p 93)* _____

_____

93. Which apolipoprotein binds to the LDL receptor? On which lipoproteins is it found? *(p 93)*

_____

94. Match the lipoprotein with its function. *(p 94)*

_____ A. Delivers dietary TGs to peripheral tissues	1. Chylomicron
_____ B. Delivers hepatic cholesterol to peripheral tissues	2. HDL
_____ C. Delivers hepatic TGs to peripheral tissues	3. IDL
_____ D. Delivers TGs and cholesterol to liver	4. LDL
_____ E. Mediates cholesterol transport from peripheral tissues to liver	5. VLDL

95. In which organ(s) is HDL produced? *(p 94)* _____

96. A 6-month-old infant presents with failure to thrive. Steatorrhea is noted, and blood tests show deficiencies in vitamins A, D, E, and K. The parents mention that changing from breast milk to low-fat formula "seemed to help." Immunohistochemical analysis shows decreased staining of ApoB-48 on intestinal biopsy and decreased staining of ApoB-100 on liver biopsy. What is the pathophysiology of the most likely disorder? What deficiencies would you expect a serum lipid panel to reveal? *(p 94)*

_____

_____

_____

_____

Answers

MOLECULAR

1. H1.
2. Heterochromatin.
3. Euchromatin. (It is less condensed and sterically accessible to transcription factors.)
4. Increased melting temperature.
5. Ribonucleotide reductase.
6. Thymidylate synthase; dihydrofolate reductase.
7. This child has Lesch-Nyhan syndrome, which is characterized by intellectual disability, self-mutilation, aggression, hyperuricemia, gout, dystonia, and macrocytosis. It is caused by the absence of HGPRT, which leads to a defective purine salvage pathway.
8. DNA polymerase III, which proofreads in the 3' to 5' direction using an exonuclease.
9. DNA polymerase I.
10. Fluoroquinolones.
11. The third position of a codon (due to tRNA wobble).
12. Alternative splicing. (In this case, the alternative splicing creates the mutation in β-thalassemia.)
13. Frameshift mutation.
14. Nucleotide excision repair.
15. During nucleotide excision repair, the entire nucleotide structure, containing the damaged bases, is removed and replaced. During base excision repair, only the base is clipped off and repaired without the entire backbone of the DNA being taken apart.
16. Mismatch repair.
17. A dramatic decrease in the level of gene transcription.

18. mRNA is the largest (**m**assive) type, tRNA is the smallest (**t**iny), and rRNA is the most **r**ampant type of RNA.

19. α-amanitin. (When consumed, it causes severe hepatotoxicity.)

20. RNA polymerase II.

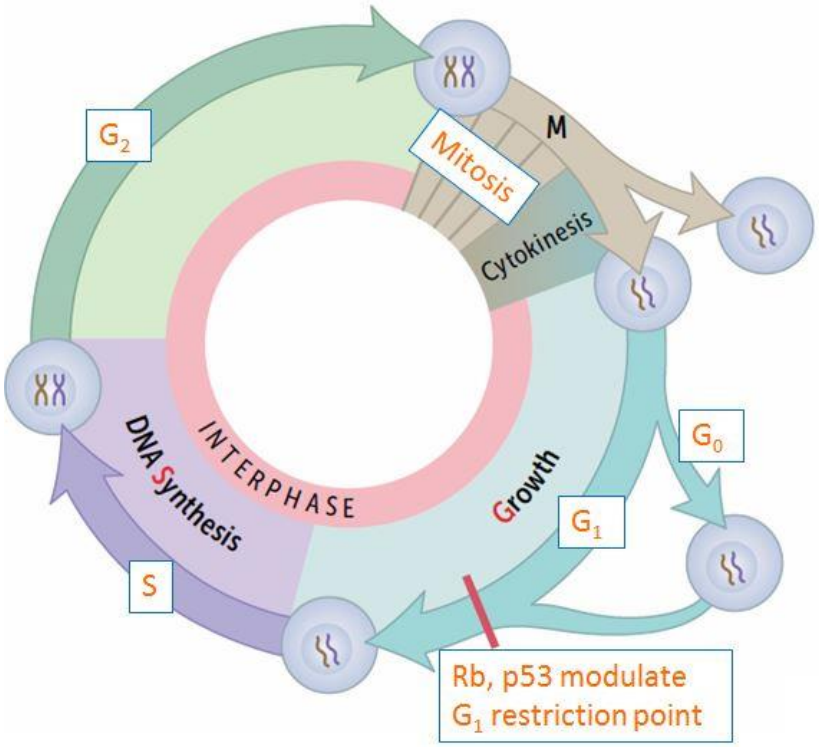
21. RNA polymerase III.

22. (1) Aminoacyl-tRNA binds to the A site. (2) rRNA ("ribozyme") catalyzes peptide bond formation, transfers growing polypeptide to the amino acid in A site. (3) The ribosome advances three nucleotides toward the 3′ end of mRNA, thereby moving the peptidyl tRNA to the P site (translocation).

23. Chaperone proteins.

CELLULAR

24.



25. Progression from G_1 to S phase. (P53 and Rb prevent defective cells from undergoing DNA synthesis.)

26. A-2, B-3, C-1.

27. Goblet cells of the small intestine (secrete mucus) and plasma cells (secrete antibodies).

28. Liver hepatocytes and steroid hormone–producing cells of the adrenal cortex and gonads.

29. I-cell disease.

30. Kinesin.

31. Griseofulvin.

32. Mebendazole.

33. Microtubules.

34. Intermediate filaments.

35. Kartagener syndrome.

36. It increases cardiac contractility by increasing intracellular calcium concentration.

37. A-4, B-1, C-2, D-3.

38. Scurvy; the limes provided the sailors with the vitamin C they were deficient in.

39. Osteogenesis imperfecta.

40. Blue sclerae.

41. Ehlers-Danlos syndrome.

42. Lysyl oxidase.

43. Fibrillin.

44. COPD. (α_1-Antitrypsin deficiency results in unopposed elastase activity, which degrades elastin; lack of α_1-antitrypsin can lead to loss of elastin in the lungs, thereby resulting in COPD.)

LABORATORY TECHNIQUES

45. Reverse transcriptase polymerase chain reaction.

46. Cas9 endonuclease.

47. Southern: DNA sample is enzymatically cleaved into smaller pieces, which are separated on a gel by electrophoresis and transferred to a filter; the filter is exposed to a radiolabeled DNA probe that recognizes and anneals to its complementary strand; the resulting double-stranded, labeled piece of DNA is visualized when the filter is exposed to film.

    Northern: Similar to Southern blot, except that an RNA sample is electrophoresed.

    Western: Sample protein is separated via gel electrophoresis and transferred to a membrane; labeled antibody is used to bind to relevant protein.

48. Flow cytometry.

49. Microarrays.

50. A Western blot has greater specificity than an ELISA.

51. FISH allows for specific localization of genes and direct visualization of chromosomal anomalies at the molecular level, including microdeletions that are too small to see on a karyotype.

52. Karyotyping.

53. miRNAs.

GENETICS

54. Incomplete penetrance.

55. If a patient inherits or develops a mutation in a tumor suppressor gene, the complementary allele must be deleted/mutated before cancer develops. This is not true of oncogenes.

56. Locus heterogeneity.

57. 2pq.

58. In lyonization (X-inactivation), one copy of female X chromosome forms a transcriptionally inactive Barr body. In mosaicism, genetically distinct cell lines are present in the same individual.

59. Prader-Willi syndrome is inherited via a mutation or deletion of the paternal allele of chromosome 15 or can occur due to maternal uniparental disomy. Symptoms include intellectual disability, hyperphagia, obesity, hypogonadism, and hypotonia.

60. Angelman syndrome is inherited via a mutation or deletion of the *UBE3A* gene on the maternal copy of chromosome 15 or can occur due to paternal uniparental disomy. Symptoms include severe intellectual disability, seizures, ataxia, and inappropriate laughter.

61. A-5, B-1, C-2, D-3, E-4.

62. 50%.

63. False. (Her sons *and* daughters may be affected.)

64. Most of the mucopolysaccharidoses (except Hunter syndrome) and sphingolipidoses (except Fabry disease) are autosomal recessive. Both Hunter syndrome and Fabry disease are X-linked recessive disorders.

65. Cystic fibrosis is due to a defect in the *CFTR* gene on chromosome 7 that affects the chloride channel.

66. Albuterol, aerosolized dornase alfa (DNase), and hypertonic saline solution.

67. Vitamins A, D, E, and K (all of which are fat-soluble).

68. A trinucleotide repeat of the sequence CTG in the *DMPK* gene, which has an autosomal dominant inheritance pattern.

69. Gowers sign. (This action is necessary due to weakness of the proximal muscles.)

70. Rett syndrome, which is caused by de novo mutation of the *MECP2* gene.

71. Fragile X syndrome. Remember: Fragile **X** = e**X**tra large testes, jaw, and ears.

72. The patient has classic symptoms of Huntington disease, which is caused by trinucleotide repeat expansion of CAG on chromosome 4. (For more on Huntington disease, see p. 520 in the Neurology chapter.)

73. Duodenal atresia.

74. *BRCA1* is on chromosome 17, *BRCA2* is on chromosome 13.

NUTRITION

75. A-10, B-3, C-6, D-7, E-5, F-4, G-12, H-13, I-11, J-8, K-9, L-1, M-2.

76. Zinc.

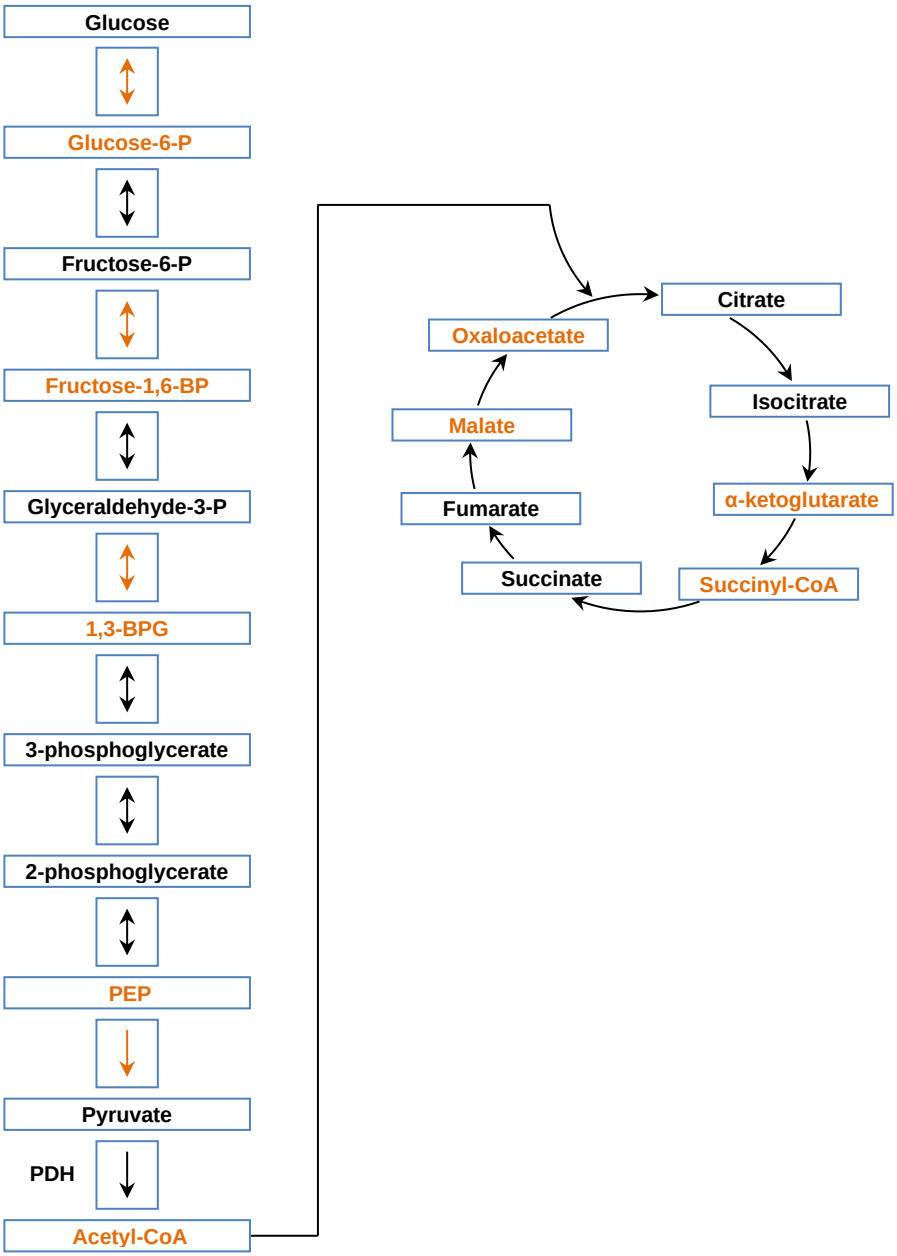
77. Edema.

78. Ethanol metabolism converts NAD+ into NADH and the high NADH/NAD+ ratio causes many of the symptoms of chronic alcohol abuse.

METABOLISM

79. A-10, B-7, C-3, D-4, E-1, F-9, G-13, H-5, I-8, J-6, K-11, L-12, M-2.

80.



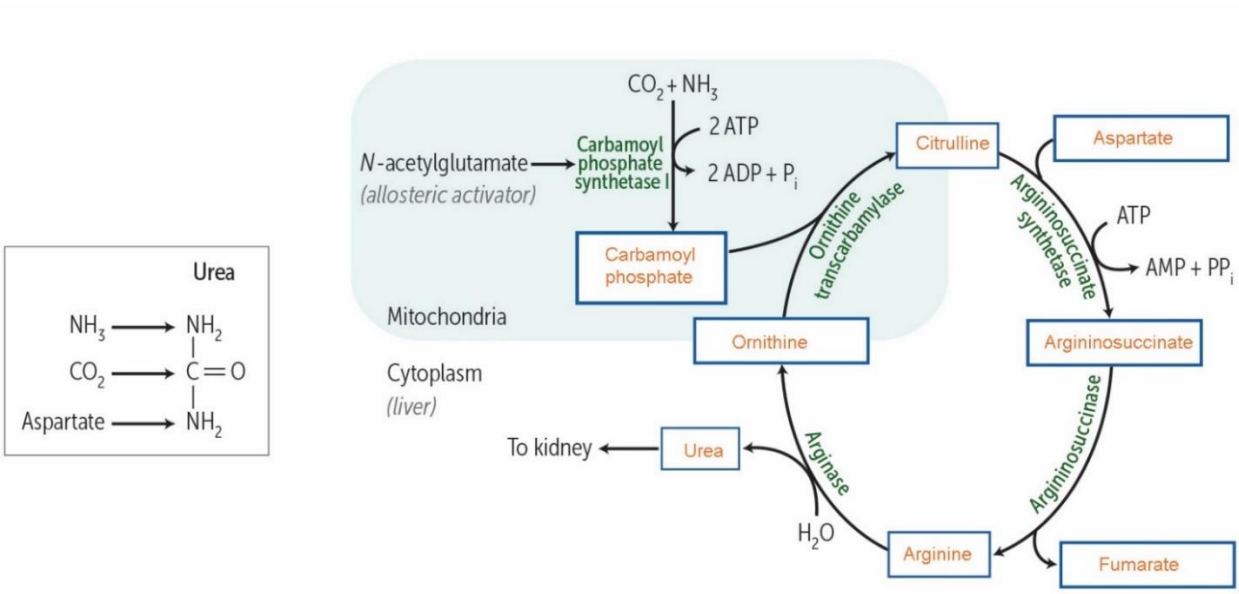
81. Aerobic metabolism of one glucose molecule produces 32 net ATP via malate-aspartate shuttle in heart and liver and 30 net ATP via glycerol-3-phosphate shuttle in muscle. Anaerobic glycolysis produces only 2 net ATP molecules per molecule of glucose.

82. Vitamins B_1, B_2, B_3, and B_5, and lipoic acid.

83. Pyruvate carboxylase, Phosphoenolpyruvate carboxykinase, fructose-1,6-bisphosphatase, and glucose-6-phosphatase.

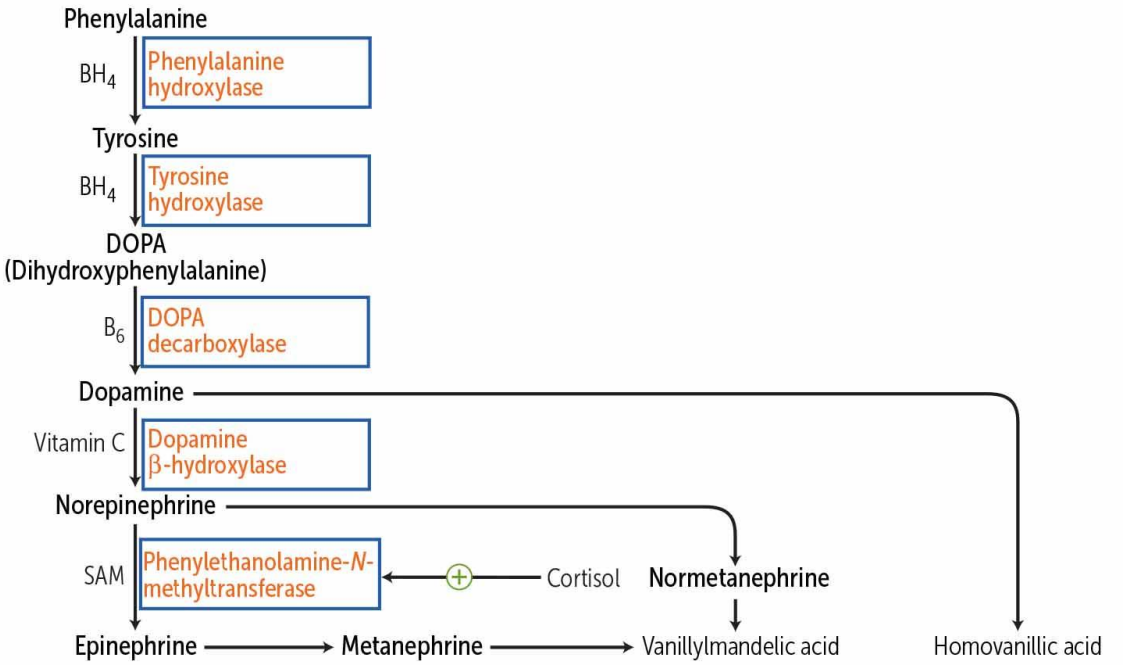
84. Heinz bodies are denatured globin chains of hemoglobin that precipitate into clumps within RBCs due to oxidative stress. Bite cells result from the phagocytic removal of Heinz bodies by splenic macrophages. Think, "**Bite** into some **Heinz** ketchup."

85.



86. Ornithine transcarbamylase deficiency. (In contrast to orotic aciduria which often presents with megaloblastic anemia.)

87.



88. Treatment for propionic acidemia is a low-protein diet limited in substances that metabolize into propionyl-CoA: **v**aline, **o**dd-chain fatty acids, **m**ethionine, **i**soleucine, and **t**hreonine (**VOMIT**).

89. X-linked recessive (XR).

90.

Disease	Deficient Enzyme	Accumulated Substance(s)
Fabry disease	α-galactosidase A	Ceramide trihexoside
Gaucher disease	glucocerebrosidase (β glucosidase)	Glucocerebroside
Hunter syndrome	Iduronate-2-sulfatase	Heparan sulfate, dermatan sulfate
Hurler syndrome	α-L-iduronidase	Heparan sulfate, dermatan sulfate
Krabbe disease	Galactocerebrosidase	Galactocerebroside, psychosine
Metachromatic leukodystrophy	Arylsulfatase A	Cerebroside sulfate
Niemann-Pick disease	Sphingomyelinase	Sphingomyelin
Tay-Sachs disease	Hexosaminidase A	GM_2 ganglioside

91. Erythrocytes (RBCs) because they have no mitochondria.

92. Hormone-sensitive lipase.

93. B-100; VLDL, IDL, LDL.

94. A-1, B-4, C-5, D-3, E-2.

95. Liver and intestine.

96. The most likely disorder is abetalipoproteinemia, which is usually caused by a deficiency of the products of the *ApoB* gene. Because patients, from birth, have difficulty making chylomicrons, they will have severe deficiencies in fat absorption, along with all fat-soluble vitamins (A, D, K, and E). Additionally, affected patients cannot make normal VLDL particles, which decrease IDL and LDL levels. Later manifestations of abetalipoproteinemia include retinitis pigmentosa and spinocerebellar degeneration (caused by low vitamin E). This may present as progressive ataxia. Acanthocytosis is also present on blood smear.

Cardiovascular

Questions

EMBRYOLOGY

1. In the embryonic heart, the right common cardinal vein and the right anterior cardinal vein jointly give rise to which vein in an adult? *(p 281)* _____

2. Which embryonic shunt diverts oxygenated blood from the inferior vena cava into the left atrium, and what is its postnatal derivative? *(p 282)* _____

3. Which embryonic shunt directs oxygenated blood into the IVC, bypassing hepatic circulation, and what is its postnatal derivative? *(p 282)* _____

4. Which embryonic shunt bypasses the high-resistance pulmonary circulation, and what is its postnatal derivative? *(p 282)* _____

5. What is the approximate oxygen saturation (%) of the blood returning from the placenta in the umbilical vein? *(p 282)* _____

6. Which drug is commonly used to close the patent ductus arteriosus? What can be used to keep it open? *(p 282)* _____

ANATOMY

7. If the right coronary artery supplies the inferior portion of the left ventricle via the posterior descending artery, is the heart right- or left-dominant? *(p 283)* _____

8. A patient has a myocardial infarction that damages the anterior interventricular septum. Which coronary artery is occluded? *(p 283)* _____

9. The left anterior descending artery and its branches supply _____ papillary muscle, while the posterior descending artery supplies _____ papillary muscle. *(p 283)*

10. Enlargement of the left atrium can compress the recurrent laryngeal nerve, causing _____, or compress the esophagus, causing _____. *(p 283)*

PHYSIOLOGY

11. In order to increase the stroke volume, one could _____ (decrease/increase) the preload, _____ (decrease/increase) the afterload, or _____ (decrease/increase) the contractility. *(p 284)*

12. A 60-year-old man receives an intravenous injection of epinephrine. Would his contractility increase or decrease? *(p 284)* _____

13. Ejection fraction = (_____ - _____)/_____. Ejection fraction is most reflective of *which* cardiac parameter? *(p 285)*

14. Cardiac output (CO) = heart rate (HR) × _____. *(p 285)*

15. Which blood vessels account for most of total peripheral resistance? *(p 286)* _____

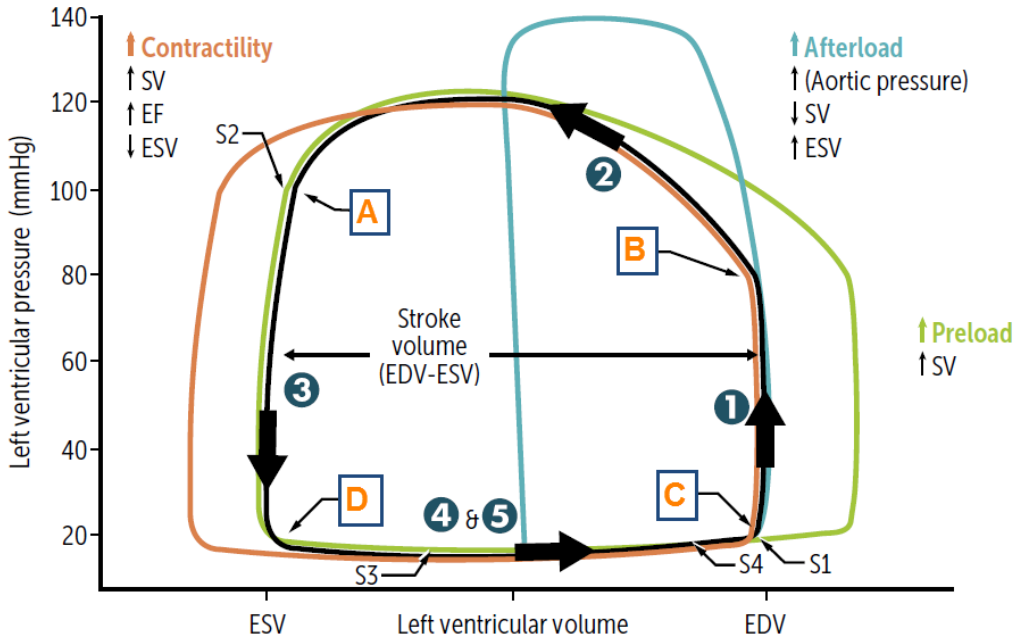
16. Which parameter does the viscosity of blood mostly depend on? *(p 286)* _____

17. A 23-year-old man has significant blood loss after a motor vehicle accident. A decrease in blood volume leads to _____ (increased/decreased) right atrial pressure and to _____ (increased/decreased) cardiac output. *(p 286)*

18. A 76-year-old man with congestive heart failure is given digoxin as a positive inotrope. An increase in inotropy leads to _____ (increased/decreased) cardiac output and to _____ (increased/decreased) right atrial pressure. *(p 286)*

19. A 10-year-old boy presents with dehydration following acute diarrhea. He receives 2 liters of normal saline. An increase in blood volume leads to _____ (increased/decreased) right atrial pressure and to _____ (increased/decreased) cardiac output. *(p 286)*

20. Fill in the blanks A–D with the correct valvular event that occurs at each stage of the left ventricular cardiac cycle. Then fill in the blanks 1–5 with the correct phase of the left ventricular cardiac cycle. *(p 287)*



A. _____

B. _____

C. _____

D. _____

1. _____

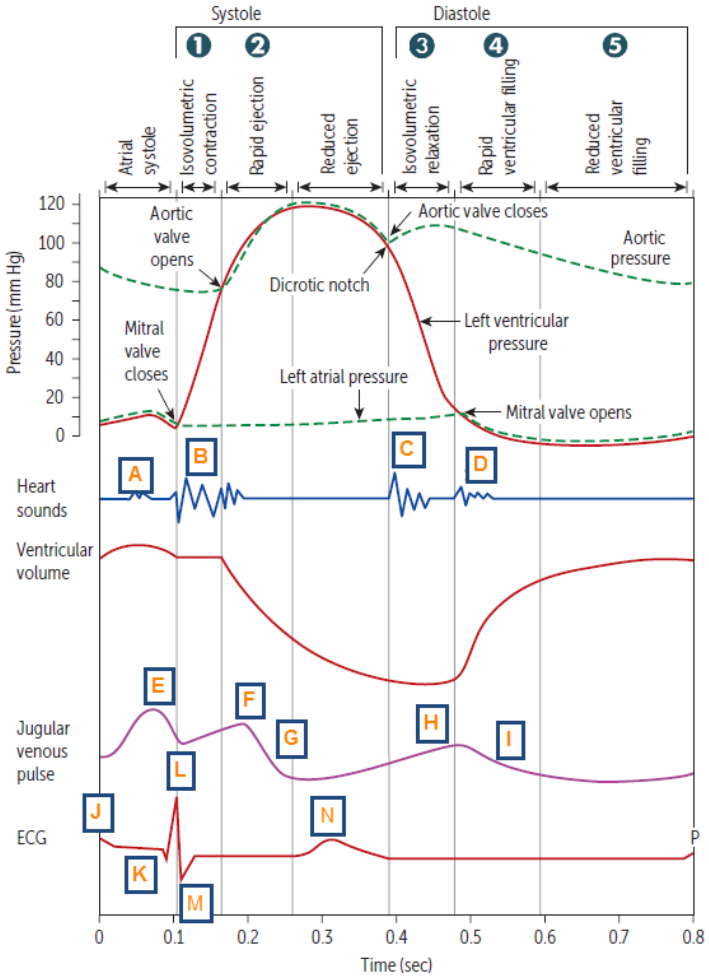
2. _____

3. _____

4. _____

5. _____

21. Fill in the blanks A–N with the correct heart sound, jugular venous pulse waveform, or ECG waveform. (Numbers refer to numbers in image in question 20.) *(pp 287, 293)*



A. _____ H. _____

B. _____ I. _____

C. _____ J. _____

D. _____ K. _____

E. _____ L. _____

F. _____ M. _____

G. _____ N. _____

22. Describe the pressures in the left ventricle and aorta for a patient with aortic stenosis. *(p 288)*

_____

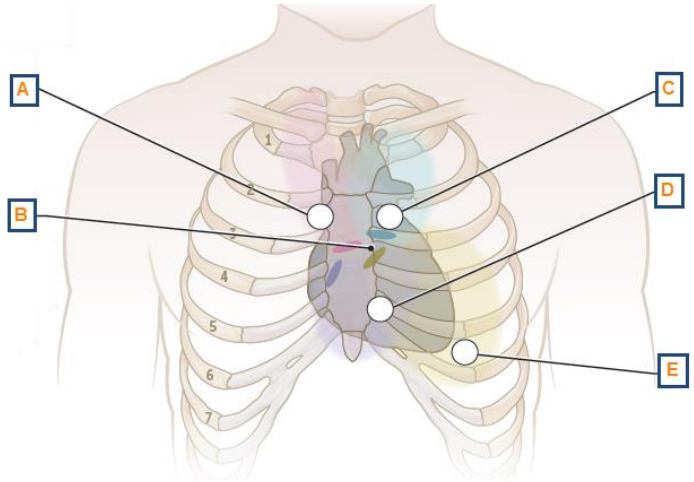
_____

23. In physiologic splitting of the S_2 heart sound, the pulmonic valve closes later during inspiration due to _____ (increased/decreased) blood flow over the pulmonic valve. *(p 289)*

24. On auscultation of a patient with an atrial septal defect during inspiration, does the time between pulmonic and aortic valvular closure increase, decrease, or stay the same? *(p 289)*

_____

25. Fill in the blanks A-E with the correct auscultation site. *(p 290)*



A. _____ D. _____

B. _____ E. _____

C. _____

26. Name three pathological processes that can cause mitral regurgitation. *(p 291)* _____

_____

27. Name four pathological processes that can cause aortic regurgitation. *(p 291)* _____

_____

28. When listening to a patient's heart, you hear a high-pitched holosystolic murmur loudest at the apex that does not increase in intensity with inspiration. You also notice that it radiates toward axilla. What is the most likely cause of this murmur? *(p 291)* _____

29. Which murmur is often caused by age-related calcification? *(p 291)* _____

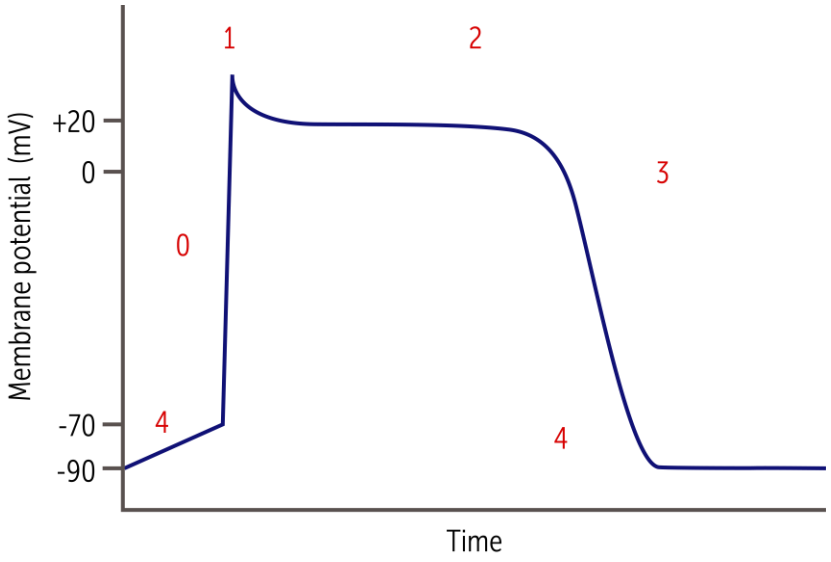
30. Six days after having a myocardial infarction, a patient presents with a new-onset murmur. Which type of murmur is the most likely? *(p 291)* _____

31. How is cardiac myocyte physiology different from that in skeletal muscle? *(p 292)* _____

_____

_____

32. For each phase of the myocardial action potential, describe the ionic current(s) responsible for each phase. *(p 292)*

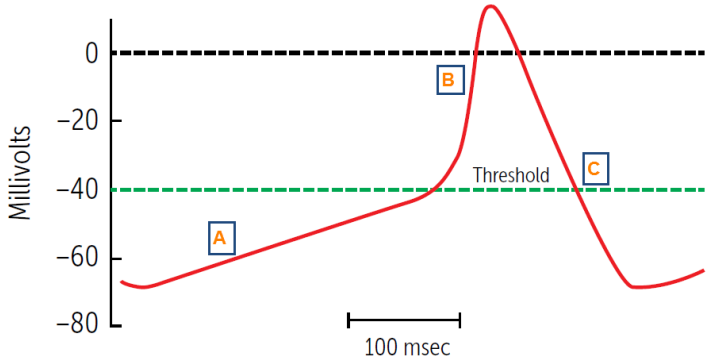


0. _____ 3. _____

1. _____ 4. _____

2. _____

33. Fill in the blanks A–C with the correct phase of the pacemaker action potential and the ionic current responsible for each phase. *(p 292)*



A. _____ C. _____

B. _____

34. As compared with the myocardial action potential, which phases are absent from the pacemaker potential? *(p 292)* _____

_____

35. Describe the ECG of patient with torsades de pointes. What is a potentially dangerous sequelae of this arrhythmia? *(p 294)* _____

_____

36. A 67-year-old man has an irregularly irregular ECG tracing during a routine visit to his doctor. What is his most likely diagnosis and what does the treatment regimen include? *(p 295)*

_____

_____

37. The ECG tracing of a 73-year-old woman shows a "sawtooth" pattern. What is her diagnosis and what can be done to treat her condition? *(p 295)* _____

_____

38. Progressive lengthening of the PR interval takes place in _____ (Mobitz type I/Mobitz type II/both Mobitz type I and type II) heart block. *(p 295)*

39. An ECG shows an erratic rhythm with no identifiable waveform. What is the most likely diagnosis? *(p 295)* _____

40. A 65-year-old man presents with an ECG tracing displaying P waves and QRS complexes that are not rhythmically associated. Which therapeutic intervention would be most appropriate? *(p 295)*

_____

41. Which infectious disease can cause third-degree (complete) AV block? *(p 295)*

_____

42. What chemical changes of blood elicit a response from peripheral chemoreceptors? How do central chemoreceptors differ? *(p 296)* _____

_____

43. In the lungs, what is the physiologic advantage of vasoconstriction in response to hypoxia? *(p 297)*

_____

44. An 80-year-old man with a history of right-sided heart failure presents with bilateral ankle edema. In terms of capillary fluid exchange, what is the mechanism by which his edema developed? *(p 297)* _____

_____

45. A 55-year-old man with longstanding alcoholic cirrhosis presents with bilateral pedal edema and ascites. In terms of capillary fluid exchange, what is the mechanism by which his edema developed? *(p 297)* _____

_____

46. A 43-year-old woman presents with bilateral pitting leg edema. Laboratory results are remarkable for high low-density lipoprotein, low albumin, and proteinuria (nephrotic syndrome). In terms of capillary fluid exchange, what is the mechanism by which her edema developed? *(p 297)*

_____

_____

_____

47. A 50-year-old Ethiopian man presents with severe bilateral leg and scrotal edema due to elephantiasis. In terms of capillary fluid exchange, what is the mechanism by which his edema developed? *(p 297)* _____

_____

PATHOLOGY

48. How do neonates with tricuspid atresia remain viable given their severely compromised circulation? *(p 298)* _____

49. What are the four clinical features of tetralogy of Fallot? *(p 298)* _____

_____

50. What must be present for a fetus with D-transposition of great vessels to remain viable? *(p 298)*

_____

_____

51. What physical exam findings are associated with coarctation of the aorta? *(p 299)* _____

_____

_____

52. Describe the murmur of patent ductus arteriosus. *(p 299)* _____

53. Which three cardiac defects are associated with Down syndrome? *(p 300)* _____

_____

54. List the risk factors for primary hypertension. *(p 300)* _____

_____

55. An 80-year-old veteran is told by his physician that he has calcification of medium-sized arteries and that the condition is relatively benign as it does not obstruct blood flow. What disease does he have? *(p 301)* _____

56. List six complications of atherosclerosis. *(p 302)* _____

_____

57. A patient presents to the emergency department with tearing chest pain radiating to the back and dies soon after presentation. What would most likely be seen on x-ray of the chest? What vascular pathology would most likely be seen at autopsy? *(p 303)* _____

_____

58. At what point is ischemic heart disease given the term "myocardial infarction"? *(p 304)*

_____

_____

59. ST-segment elevation MI on an ECG indicates _____ (subendocardial/transmural) infarction of the myocardium, but Non-ST-segment elevation MI indicates _____ (subendocardial/transmural) infarction. *(p 304)*

60. List eight symptoms of a myocardial infarction. *(p 305)* _____

_____

_____

61. Describe the time frame for events after a myocardial infarction. *(p 305)*

A. Early coagulative necrosis becomes apparent _____.

B. Extensive coagulative necrosis. Tissue around infarct shows acute inflammation with neutrophils _____.

C. Macrophages, then granulation tissue at margins appear _____.

D. Contracted scar complete _____.

62. After a myocardial infarction, when is the patient at the greatest risk for the development of an arrhythmia? When is the risk for free wall rupture or interventricular septal rupture the greatest? When is the risk for ventricular aneurysm the greatest? *(p 305)* _____

_____

63. Which ECG leads are best for diagnosing an infarct of the left anterior descending artery? *(p 306)*

_____

64. A 16-year-old boy presents for a school physical. Physical examination reveals a 3/6 systolic murmur at the left sternal border. Upon questioning, he mentions that he has had several fainting episodes. His father, a former soccer player, had similar episodes and died suddenly at the age of 25 years. What is this patient's most likely diagnosis? What would a cardiac biopsy specimen reveal? *(p 308)* _____

_____

65. In heart failure, _____ (increased/decreased) cardiac output leads to _____ (increased/decreased) activity of renin-angiotensin-aldosterone, which leads to _____ (increased/decreased) systemic venous pressure, and ultimately the physical finding of _____ (peripheral/pulmonary) edema. *(p 309)*

66. In heart failure, _____ (increased/decreased) left ventricular contractility leads to _____ (increased/decreased) pulmonary venous pressure, ultimately leading to _____ (peripheral/pulmonary) edema. *(p 309)*

67. What physical exam findings are associated with cardiac tamponade? *(p 310)* _____

_____

_____

68. With respect to bacterial endocarditis, what symptoms and signs are represented by the mnemonic **FROM JANE**? *(p 311)* _____

_____

69. Rheumatic fever is a secondary to infection by which organism? *(p 312)* _____

_____

70. List the components of the **J♥NES** mnemonic for rheumatic heart disease. *(p 312)* _____

_____

_____

71. A 70-year-old former prostitute presents chest pain radiating to the back and worsening shortness of breath. Her cardiac enzymes are negative and she has no ST changes on ECG. Echocardiography shows aortic regurgitation and a dilated aortic root. Laboratory tests are significant for a positive rapid plasma reagin. What is the most likely cause of her pain and shortness of breath? *(p 312)* _____

72. What symptoms might patients with myocarditis display? *(p 313)* _____

_____

73. What clinical findings are associated with Buerger disease? *(p 314)* _____

_____

74. A 7-year-old Japanese child presents with a 1-week history of fever, erythema of the conjunctiva and tongue, and desquamation of the palms of the hands. What is the most likely diagnosis? What is the preferred treatment? *(p 314)* _____

_____

75. Which infectious disease is strongly associated with polyarteritis nodosa? *(p 314)* _____

_____

76. What are the arteriogram findings seen in polyarteritis nodosa? *(p 314)* _____

_____

77. A 75-year-old woman presents with new-onset right jaw pain and headache at the right temple. What is the most likely diagnosis? *(p 314)* _____

78. Temporal arteritis is associated with what laboratory finding? *(p 314)* _____

_____

79. List nine signs or symptoms of granulomatosis with polyangiitis (Wegener). *(p 315)* _____

_____

_____

80. In eosinophilic granulomatosis with polyangiitis (Churg-Strauss), the patient will test positively for _____ (MPO-ANCA/p-ANCA or PR3-ANCA/c-ANCA) in the serum. In granulomatosis with polyangiitis (Wegener), the patient will test positively for _____ (MPO-ANCA/p-ANCA or PR3-ANCA/c-ANCA). *(p 315)*

81. Patients with Churg-Strauss syndrome usually present with which signs and symptoms? *(p 315)*

_____

_____

82. A 7-year-old boy with a recent viral upper respiratory tract infection now presents with worsening abdominal pain. Purpura develops on his legs. What is the most likely diagnosis? *(p 315)* _____

_____

83. Which cardiac tumor may present with multiple syncopal episodes? *(p 316)* _____

_____

PHARMACOLOGY

84. Why are angiotensin-converting enzyme inhibitors especially important for patients with diabetes mellitus? *(p 316)* _____

85. What four agents are first-line therapy for hypertension in pregnancy? *(p 316)* _____

_____

86. For each of the following vasoactive substances, fill out the table by identifying which signaling pathway the drug stimulates/inhibits and whether it causes vasoconstriction or vasodilation. *(p 317)*

Vasoactive substance	**G_s/cAMP, G_i/cAMP, cGMP, G_q/IP_3, or V-gated Ca^{2+} channel?**	**Stimulates or inhibits the pathway?**	**Vasodilation or vasoconstriction?**
Nicardipine			
Milrinone			
ANP			
Terbutaline (β_2 agonist)			
Nitric Oxide			
Vasopressin			
Acetylcholine			
Sildenafil			
Phenylephrine (α_1-agonist)			

87. A patient is started on antihypertensive therapy. One week later he returns, complaining of swollen ankles. Which class of medication was he likely prescribed? *(p 318)* _____

_____

88. List four adverse effects of nitroglycerin. *(p 318)* _____

_____

89. What is the effect of nitrates on contractility? What is the effect of nitrates with β-blockers on contractility? *(p 319)* _____

90. By which mechanism can medications reduce angina? *(p 319)* _____

_____

_____

91. What are the adverse effects of Sacubitril? *(p 319)* _____

_____

92. A 50-year-old man with hypercholesterolemia is deficient in vitamins A, D, E, and K. He also complains of gastrointestinal discomfort since starting a lipid-lowering agent. Which lipid-lowering agent is the most likely cause? *(p 320)* _____

93. Digoxin inhibits which mechanism of transport in the cell membrane? *(p 321)* _____

94. What are the mechanisms of action of cardiac glycosides? *(p 321)* _____

_____

95. Facial rash, fever, and joint pain develop in a female patient who is taking procainamide for an arrhythmia. Anti-histone antibodies are present in her serum. What is the most likely diagnosis? *(p 322)* _____

96. Symptoms of headache and tinnitus related to quinidine use are collectively known as: *(p 322)*

_____

97. What are the toxicities of β-blockers? *(p 323)* _____

_____

98. What is the mechanism of action of β-blockers? *(p 323)* _____

_____

99. What three types of testing must be performed periodically for patients who take amiodarone? *(p 323)* _____

100. What is a potentially fatal adverse effect of Ibutilide? *(p 323)* _____

101. What are the adverse effects of calcium channel blockers (class IV)? *(p 324)* _____

_____

102. Which antiarrhythmic is a first-line drug for diagnosing and terminating supraventricular tachycardia (SVT)? *(p 324)* _____

103. Name five toxicities of adenosine. *(p 324)* _____

_____

104. Which ion is infused to treat torsades de pointes and digoxin toxicity? *(p 324)* _____

_____

Answers

EMBRYOLOGY

1. Superior vena cava (SVC).
2. Foramen ovale and fossa ovalis.
3. Ductus venosus and ligamentum venosum.
4. Ductus arteriosus and ligamentum arteriosum.
5. 80%.
6. Indomethacin helps close PDA, whereas prostaglandins E_1 and E_2 can keep it open.

ANATOMY

7. Right-dominant.
8. The left anterior descending artery.
9. Anterolateral; posteromedial.
10. Hoarseness; dysphagia.

PHYSIOLOGY

11. Increase; decrease; increase.
12. Increase.
13. Ejection Fraction = [(end diastolic volume)- (end systolic volume)]/end diastolic volume, and is most reflective of the myocardial contractility.
14. Stroke volume (SV).
15. Arterioles.

16. Hematocrit.

17. Decreased; decreased.

18. Increased; increased.

19. Increased; increased.

20. A = Aortic valve closes; B = Aortic valve opens; C = Mitral valve closes; D = Mitral valve opens.

    1 = Isovolumetric contraction; 2 = Systolic ejection; 3 = Isovolumetric relaxation; 4 = Rapid filling.

    5 = Reduced filling.

21. A = S4—atrial kick, caused by high atrial pressure and associated with ventricular noncompliance (eg, hypertrophy).

    B = S1—mitral and tricuspid valve closure.

    C = S2—aortic and pulmonary valve closure.

    D = S3—in early diastole during rapid ventricular filling phase. Associated with increased filling pressures, and more common in dilated ventricles.

    E = a wave—atrial contraction.

    F = c wave—RV contraction (closed tricuspid valve bulging into right atrium).

    G = x descent—downward displacement of closed tricuspid valve during rapid ventricular ejection phase.

    H = v wave—increased right atrial pressure due to filling against a closed tricuspid valve.

    I = y descent—RA emptying into RV.

    J = P wave—atrial depolarization.

    K = QRS complex—ventricular depolarization.

    L = QRS complex—ventricular depolarization.

    M = QRS complex—ventricular depolarization.

    N = T wave—ventricular repolarization.

22. In a patient with aortic stenosis, the stenotic valve causes increased afterload of the left ventricle. Thus, the left ventricular pressure is higher than the pressure after the valve (in the aorta).

23. Increased.

24. Stays the same. (Because pressures can equalize across the atrial wall, there is no change in splitting during inspiration.)

25. A = Aortic area; B = left sternal border; C = pulmonic area; D = tricuspid area; E = mitral area (apex).

26. Ischemic heart disease (post-MI), mitral valve prolapse (MVP), or left ventricular (LV) dilatation.

27. **B**icuspid aortic valve, **e**ndocarditis, **a**ortic root dilatation, or **r**heumatic fever (**BEAR**).

28. Mitral valve regurgitation.

29. Aortic stenosis.

30. Holosystolic murmur of mitral regurgitation, best heard over the apex of the heart.

31. The cardiac muscle action potential has a plateau due to calcium influx and potassium efflux. Cardiac muscle contraction requires calcium influx from ECF to induce Ca^{2+} release from sarcoplasmic reticulum and cardiac myocytes are electrically coupled to each other via gap junctions.

32. Phase 0: Na^+ influx.

    Phase 1: K^+ efflux.

    Phase 2: Ca^{2+} influx and K^+ efflux.

    Phase 3: K^+ efflux.

    Phase 4: K^+ efflux (leak channels); Na^+ efflux and K^+ influx (Na^+/K^+/ATPase)

33. Phase 4: Na^+ and K^+ influx (“funny current”).

    B = Phase 0; Ca^{2+} influx.

    C = Phase 3; K^+ efflux.

34. Phases 1 and 2.

35. ECG characterized by shifting sinusoidal waveforms. It can progress to ventricular fibrillation.

36. Atrial fibrillation. Treatment includes rate and rhythm control, anticoagulation, and/or cardioversion.

37. Atrial flutter. Treat like atrial fibrillation +/– catheter ablation.

38. Mobitz type I (Wenckebach). Type I involves progressive lengthening followed by a dropped beat. In type II, dropped beats are not preceded by progressive lengthening.

39. Ventricular fibrillation.

40. A pacemaker.

41. Lyme disease.

42. High P_{CO_2}, low pH of blood, and low P_{O_2} (< 60 mm Hg). Central chemoreceptors do not directly respond to P_{O_2}.

43. This mechanism allows for only well-ventilated areas to remain perfused, optimizing gas exchange.

44. Heart failure results in increased capillary pressure, which causes fluid to move out of the capillaries and into the interstitium.

45. Liver failure results in decreased plasma proteins, which decreases plasma colloid oncotic pressure, and in turn causes fluid to move out of the capillaries and into the interstitium.

46. Nephrotic syndrome results in proteinuria and subsequent hypoalbuminemia, thus decreasing plasma colloid oncotic pressure, which in turn causes fluid to move out of the capillaries and into the interstitium.

47. Lymphatic obstruction results in increased interstitial fluid colloid osmotic pressure, which causes fluid to move out of the capillaries and into the interstitium.

PATHOLOGY

48. To maintain viability, both an ASD and a VSD are required for babies with tricuspid atresia.

49. **P**ulmonary infundibular stenosis, **R**ight ventricular hypertrophy, **O**verriding aorta, and **V**entricular septal defect (VSD). (Remember: **PROV**e).

50. A shunt must be present, which allows adequate mixing of blood (eg, VSD, PDA, or patent foramen ovale).

51. Notched ribs (on CXR) due to increased collateral circulation, hypertension in the upper extremities, and weak, delayed pulse in the lower extremities.

52. Continuous "machine-like" murmur.

53. ASD, VSD, and atrioventricular (AV) septal defect.

54. Increased age, obesity, diabetes, physical inactivity, excess salt intake, excess alcohol intake, cigarette smoking, and family history.

55. Mönckeberg sclerosis (medial calcific sclerosis).

56. Infarcts, peripheral vascular disease, thrombus, emboli, aneurysms, and ischemia.

57. Mediastinal widening. Longitudinal intraluminal tear forming a false lumen, both of which are indicative of aortic dissection.

58. Most often due to rupture of coronary artery atherosclerotic plaque, resulting in acute thrombosis; elevation of cardiac biomarkers (troponins, CK-MB) are diagnostic.

59. Transmural infarct; subendocardial infarct.

60. Severe retrosternal pain, nausea, vomiting, pain in the left arm and/or jaw, diaphoresis, shortness of breath, and fatigue.

61. A = 0-24 hours; B = 1-3 days; C = 3-14 days; D = 2 weeks to several months.

62. First 0-24 hours; 3-14 days, 2 weeks to several months after MI.

63. Leads V_1 to V_6.

64. Hypertrophic obstructive cardiomyopathy; biopsy shows marked ventricular concentric hypertrophy, often septal predominance. Myofibrillar disarray and fibrosis.

65. Decreased; increased; increased; peripheral edema.

66. Decreased; increased; pulmonary edema.

67. Beck triad (hypotension, distended neck veins, distant heart sounds), increased heart rate, and pulsus paradoxus.

68. **FROM JANE** = **F**ever, **R**oth spots, **O**sler nodes, **M**urmur, **J**aneway lesions, **A**nemia, **N**ail-bed hemorrhage, and **E**mboli.

69. Group A β-hemolytic streptococci.

70. **J♥NES** = **J**oint (migratory polyarthritis) ♥ carditis; **N**odules in skin (subcutaneous); **E**rythema marginatum (evanescent rash with ring margin), **S**ydenham chorea**.**

71. Ascending aortic aneurysm due to syphilitic heart disease (tertiary syphilis).

72. Myocarditis presentation is highly variable, and can include dyspnea, chest pain, fever, and arrhythmias. Persistent tachycardia out of proportion to fever is characteristic.

73. Intermittent claudication, superficial nodular phlebitis, and Raynaud phenomenon. Additionally, autoamputation of digits and gangrene can be seen.

74. Kawasaki disease; treat with intravenous immunoglobulin and aspirin.

75. Hepatitis B (seropositivity in 30% of patients).

76. Innumerable renal microaneurysms and spasms on arteriogram (string of pearls appearance).

77. Giant cell (temporal) arteritis.

78. Elevated (ESR) erythrocyte sedimentation rate.

79. Perforation of the nasal septum, chronic sinusitis, otitis media, mastoiditis, hemoptysis, cough, dyspnea, hematuria, and red cell casts.

80. MPO-ANCA/p-ANCA; PR3-ANCA/c-ANCA.

81. Asthma, sinusitis, skin nodules or purpura, and peripheral neuropathy (eg, wrist/foot drop).

82. Immunoglobulin A vasculitis, also called Henoch-Schönlein purpura.

83. Myxoma; syncope can occur with “ball-valve” obstruction in the left atrium.

PHARMACOLOGY

84. ACE inhibitors/ARBs are protective against diabetic nephropathy.

85. Hydralazine, labetalol, methyldopa, and nifedipine.

86.

Vasoactive substance	**G_s/cAMP, G_i/cAMP, cGMP, G_q/IP_3, or V-gated Ca^{2+} channel?**	**Stimulates or inhibits the pathway?**	**Vasodilation or vasoconstriction?**
Nicardipine	V-gated Ca^{2+} channel	Inhibits	Vasodilation
Milrinone	G_s/cAMP	Stimulates (disinhibits)	Vasodilation
ANP	cGMP	Stimulates	Vasodilation
Terbutaline (β_2 agonist)	G_s/cAMP	Stimulates	Vasodilation
Nitric Oxide	cGMP	Stimulates	Vasodilation
Vasopressin	G_q/IP3	Stimulates	Vasoconstriction
Acetylcholine	cGMP	Stimulates	Vasodilation
Sildenafil	cGMP	Stimulates (disinhibits)	Vasodilation
Phenylephrine (α_1-agonist)	G_q/IP3	Stimulates	Vasoconstriction

87. Calcium channel blockers.

88. Reflex tachycardia, hypotension, flushing, headache, “Monday disease” in industrial exposure.

89. Increased effect; little to no effect.

90. Reduction of myocardial oxygen consumption by decreasing one or more of the determinants of MVO_2: end-diastolic volume, blood pressure, heart rate, and contractility.

91. Hypotension and dizziness can be secondary to over-diuresis. Hyperkalemia, cough.

92. Bile acid resins.

93. Na^+/K^+ ATPase.

94. They increase intracellular calcium (thereby acting as a positive inotrope) and stimulate the vagus nerve.

95. Reversible SLE-like syndrome.

96. Cinchonism (which can occur with all quinine derivatives).

97. Impotence, exacerbation of COPD and asthma, cardiovascular effects (bradycardia, AV block, and HF), and CNS effects (sedation and sleep alterations). May mask signs of hypoglycemia.

98. β-Blockers decrease SA and AV nodal activity by decreasing cAMP and calcium ion currents; they suppress abnormal pacemakers by decreasing the slope of phase 4.

99. Pulmonary function (PFTs), liver function (LFTs), and thyroid function tests (TFTs).

100. Torsades de pointes.

101. Constipation, flushing, edema, and cardiovascular effects (HF, AV block, sinus node depression).

102. Adenosine.

103. Flushing, hypotension, chest pain, sense of impending doom, and bronchospasm.

104. Magnesium.

Gastrointestinal

Questions

EMBRYOLOGY

1. What are the critical weeks of midgut development? *(p 358)* _____

   _____

2. Describe the major differences between gastroschisis and omphalocele. *(p 358)* _____

   _____

   _____

3. A newborn is noted to choke and vomit immediately after first feeding. The mother had polyhydramnios during pregnancy, and abdominal x-ray shows large amounts of air throughout the bowel. What is the most likely diagnosis? *(p 359)* _____

4. Hypertrophic pyloric stenosis leads to what problem? *(p 359)* _____

   _____

5. What is the treatment for hypertrophic pyloric stenosis? *(p 359)* _____

6. The head of the pancreas is derived from the _____ (ventral/dorsal) pancreatic bud, the body is derived from the _____ (ventral/dorsal) pancreatic bud, and the tail is derived from the _____ (ventral/dorsal) pancreatic bud. *(p 360)*

ANATOMY

7. Which GI ligament can be incised to access the lesser sac and which cannot? Why? *(p 361)* ____

_____

_____

8. Name the four histologic layers of the GI tract, from inside to out. *(p 362)* _____

_____

9. What histologic feature distinguishes the duodenum from any other part of the GI tract? What is the purpose of this feature? *(pp 362, 372)* _____

_____

10. What are the three branches of the celiac trunk? *(p 364)* _____

_____

11. Portal hypertension can lead to varices of which three structures? *(p 365)* _____

_____

12. Which type of hemorrhoid is painful? Why? *(p 366)* _____

_____

13. Which zone of the liver is most sensitive to ischemic injury? *(p 367)* _____

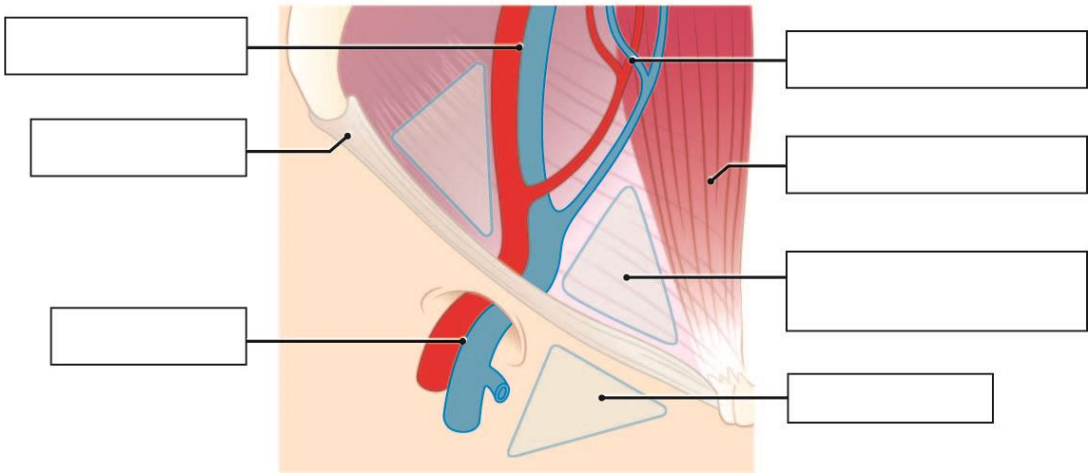
14. What is the order of major structures that pass through the femoral region from lateral to medial? *(p 368)* _____

15. Name the two fascia layers and one muscle layer that surrounds each testicle, and identify which abdominal wall structure each one is derived from. *(p 369)* _____

_____

_____

16. In the image below, identify the structures of the abdominal wall indicated below. *(pp 369-370)*



17. The gastroesophageal junction is displaced in _____ hernias, whereas it is undisturbed in _____ hernias. *(p 370)*

18. How does the course of a direct inguinal hernia differ from that of an indirect inguinal hernia? *(p 370)* _____

_____

PHYSIOLOGY

19. Which cells are responsible for secreting cholecystokinin (CCK)? What are the effects of CCK secretion? *(p 371)* _____

_____

_____

20. What cells are responsible for producing gastric acid? What hormones act on them to cause secretion? *(p 372)* _____

_____

21. Where in the GI tract is iron absorbed? Vitamin B_{12}? Folate? Which requires cofactors to facilitate absorption? *(p 374)* _____

_____

22. Peyer patches contain B cells, which primarily secrete which class of immunoglobulin? *(p 374)*

_____

23. What is the composition of bile? *(p 374)* _____

_____

24. Direct bilirubin is _____ (conjugated/unconjugated) with glucuronic acid and is _____ (soluble/insoluble) in water. Indirect bilirubin is _____ (conjugated/unconjugated) and is _____ (soluble/insoluble) in water. *(p 375)*

25. How is urobilinogen removed from the body? *(p 375)* _____

_____

PATHOLOGY

26. What are two causes of sialolithiasis? *(p 376)* _____

27. How do the symptoms of achalasia differ from those of esophageal obstruction? *(p 376)* _____

_____

_____

28. What is the characteristic imaging finding in a patient with achalasia? *(p 376)* _____

29. What are the symptoms of Plummer-Vinson syndrome? *(p 377)* _____

_____

30. What is a more common type of esophageal cancer in the United States? Worldwide? Why? *(p 378)* _____

_____

31. What is a risk factor for acute gastritis? For chronic gastritis? *(p 379)* _____

_____

32. What are the five major risk factors for gastric cancer? *(p 379)* _____

_____

33. What are four common stomach cancer metastases? *(p 379)* _____

_____

34. The pain of gastric ulcers is _____ (increased/decreased) with meals, whereas the pain of duodenal ulcers is _____ (increased/decreased) with meals. *(p 380)*

35. Name the five symptoms common to all malabsorption syndromes. *(p 381)* _____

_____

36. What are three causes of pancreatic insufficiency? What is a major consequence? *(p 381)* _____

_____

_____

37. Celiac disease is characterized by antibodies to _____, _____, and _____, and is associated with a skin condition called _____. *(p 381)*

38. Compare and contrast the characteristics of Crohn disease and ulcerative colitis. *(p 382)*

Characteristic	Crohn Disease	Ulcerative Colitis
Associated with colorectal cancer?		
Gross morphology		
Depth of inflammation		
Distinguishing complications		
Granulomas?		
Location		
Rectal involvement		

39. How is the McBurney point used to diagnose appendicitis? *(p 383)* _____

_____

40. An older man presents with subacute onset of left lower quadrant pain. He has a fever. He reports a high fat, low fiber diet. What is the most likely diagnosis? *(p 383)* _____

_____

41. What is the difference between a false diverticulum and a true diverticulum? *(p 383)* _____

_____

_____

42. _____ (Intussusception/Volvulus) occurs when a portion of the bowel twists around its mesentery; _____ (intussusception/volvulus) occurs when a proximal bowel segment telescopes into a distal segment. *(pp 385-386)*

43. What surgical complication is this a common cause of small bowel obstruction? *(p 386)* _____

_____

44. A 55-year-old woman presents with colicky pain. Results of a fecal occult blood test are positive. Colonoscopy reveals thousands of polyps in the colon and rectum. What is the most likely diagnosis? What if the patient also has osteosarcoma? What if, instead, she has a CNS glioma? *(p 387)* _____

_____

45. What is the first mutational event typically associated with colorectal cancer? *(p 389)* _____

_____

46. What are the signs and symptoms of cirrhosis and portal hypertension? *(p 389)* _____

_____

_____

47. In alcoholic hepatitis, the AST level is _____ (greater than/less than) the ALT level; in viral hepatitis, the AST level is _____ (greater than/less than) the ALT level. *(p 390)*

48. Match the type of liver disease with its notable characteristic(s) *(pp 391-392)*

_____ A. α_1-Antitrypsin deficiency	1. Causes panacinar emphysema
_____ B. Alcoholic cirrhosis	2. Thrombosis or compression of hepatic veins
_____ C. Alcoholic hepatitis	3. Fatty changes in macrovesicles; reversible
_____ D. Budd-Chiari syndrome	4. Mallory bodies
_____ E. Hepatic steatosis	5. Portal hypertension
_____ F. Hepatocellular carcinoma	6. Primary malignant liver tumor in adults

49. A newborn presents with persistent jaundice after two weeks of life, darkening urine, acholic stools, and hepatomegaly. The labs indicate high direct bilirubin and GGT. What is the likely diagnosis? *(p 393)* _____

_____

50. Compare and contrast the characteristics of the hereditary hyperbilirubinemias. *(p 394)*

Characteristic	Crigler-Najjar Syndrome	Dubin-Johnson Syndrome	Gilbert Syndrome
Impairment			
Course of disease			
Symptoms			

51. What molecule accumulates to cause Wilson disease? What molecule is not made (tests show low levels) because of this accumulation? What is the treatment? *(p 395)* _____

_____

52. What causes the classic triad of: cirrhosis, diabetes mellitus, and “bronze diabetes”? *(p 395)*

_____

_____

53. List three extrahepatic causes of biliary obstruction. *(p 395)* _____

_____

54. List two intrahepatic causes of biliary obstruction. *(p 395)* _____

_____

55. Match the term with its definition. *(pp 396-397)*

_____ A. Ascending cholangitis
_____ B. Cholecystitis
_____ C. Cholelithiasis

1. Presence of gallstones
2. Infection of biliary tree
3. Inflammation of the gallbladder

56. What enzymes are elevated in acute pancreatitis? *(p 397)* _____

57. Name one common cause of chronic pancreatitis *(p 397)* _____

PHARMACOLOGY

58. List the most common histamine-2 blockers for the GI tract. Which histamine receptor do they affect? *(p 399)* _____

59. What are the proton pump inhibitors? Why are they such effective drugs? *(p 399)* _____

_____

_____

60. How is misoprostol most commonly used as a GI agent? *(p 399)* _____

_____

61. What is the most dangerous adverse effect of all antacids? *(p 399)* _____

62. What powerful medicine is used to control vomiting and nausea after surgery? What receptor does it target? *(p 400)* _____

63. What drug can be used to treat gastroparesis? What is a worrisome adverse effect? *(p 400)* ____

_____

64. What enzymes does orlistat inhibit? What are the most common side effects? *(p 400)*

_____

_____

Answers

EMBRYOLOGY

1. Week 6: herniation of midgut through umbilical ring
   Week 10: returns to abdominal cavity and rotates around SMA, 270 degrees counterclockwise.

2. Gastroschisis: Caused by failure of lateral fold closure; extrusion of abdominal contents through abdominal folds, typically right of umbilicus; abdominal contents NOT covered in peritoneum or amnion; is not associated with chromosome abnormalities; prognosis is favorable. Omphalocele: Caused by failure of lateral walls to migrate at umbilical ring, leading to persistent midline herniation of abdominal contents into umbilical cord; abdominal contents ARE surrounded by peritoneum; associated with congenital anomalies (eg, trisomies 13 and 18, Beckwith-Wiedemann syndrome) and other structural abnormalities.

3. Esophageal atresia with distal tracheoesophageal fistula.

4. Gastric outlet obstruction. (A classic sign is nonbilious projectile vomiting.)

5. Surgical incision of the pyloric muscles (pyloromyotomy).

6. Ventral AND dorsal (ventral = uncinate process); dorsal; dorsal.

ANATOMY

7. The gastrohepatic ligament may be cut during surgery to access the lesser sac because there is a thin minimally vascular portion that does not require violating the gastric arteries. The hepatoduodenal ligament may NOT be incised, as the portal triad runs longitudinally through this ligament.

8. **M**ucosa, **s**ubmucosa, **m**uscularis externa, and **s**erosa (when intraperitoneal), adventitia (when retroperitoneal). Remember: inside to outside–MSMS.

9. Brunner glands; these glands secrete bicarbonate solution to neutralize acidic chyme that leaves the stomach before it can reach the rest of the intestines.

10. Left gastric artery, splenic artery, and common hepatic artery.

11. Esophageal varices, Caput medusae (umbilicus), and anorectal varices.

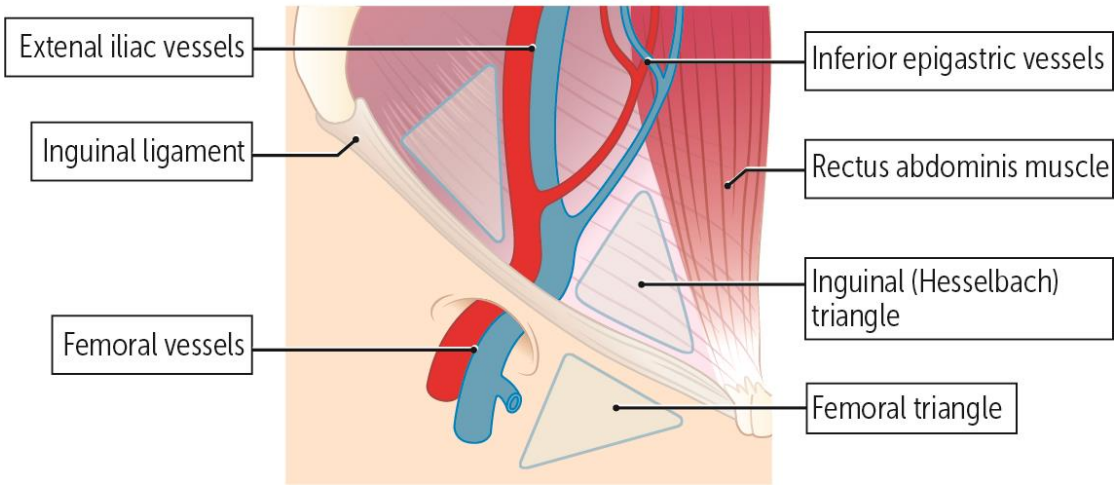
12. External hemorrhoids are painful because they receive somatic innervation.

13. Zone III (centrilobular zone).

14. Femoral nerve, femoral artery, femoral vein, lymphatics (femoral canal). Remember: You go from lateral to medial to find your **NAVeL** – **N**erve-**A**rtery-**V**ein-**L**ymphatics.

15. From deep to superficial, the testicle is surrounded by the internal spermatic fascia (from the transversalis fascia), the cremasteric muscle (from the internal oblique muscle), and the external spermatic fascia (from the external oblique aponeurosis).

16.



17. Sliding hiatal hernias; paraoesophageal hiatal hernias.

18. A direct inguinal hernia protrudes through the inguinal (Hesselbach) triangle (medial to inferior epigastric vessels), whereas an indirect inguinal hernia goes through the internal inguinal ring, external inguinal ring, and into the groin (lateral to inferior epigastric vessels).

PHYSIOLOGY

19. CCK is released by the I cells in the duodenum and jejunum. It acts on the neural muscarinic pathways to cause pancreatic secretion and relaxation of the sphincter of Oddi. It also results in increased gallbladder contraction and decreased gastric emptying.

20. Parietal cells. Histamine, acetylcholine and gastrin contribute to acid secretion.

21. Iron is absorbed in the duodenum, vitamin B_{12} is absorbed in the ileum; and folate is absorbed in the small bowel. Vitamin B_{12} absorption requires a cofactor (intrinsic factor), whereas iron and folate absorption do not.

22. Peyer patches contain B cells that differentiate into IgA-secreting plasma cells, which combat intraluminal antigens.

23. Bile salts, phospholipids, cholesterol, bilirubin, water, and ions.

24. Conjugated; soluble; unconjugated; insoluble.

25. About 80% is excreted as stercobilin in the feces; of the other 20%, about 10% is excreted in the urine as urobilin and about 90% returns to the liver via enterohepatic circulation.

PATHOLOGY

26. Dehydration or trauma.

27. Esophageal obstruction causes dysphagia with solids only, whereas achalasia causes dysphagia with both solids and liquids.

28. A “bird’s beak,” or dilated esophagus with an area of distal stenosis.

29. Dysphagia, iron deficiency anemia, and esophageal webs; may be associated with glossitis.

30. More common in America: adenocarcinoma; worldwide: squamous cell carcinoma. Chronic GERD is common in the U.S. and can result in Barrett esophagus, which in turn can lead to adenocarcinoma.

31. Acute: daily NSAID use; chronic: *Helicobacter (H) pylori* infection.

32. *H pylori* infection, diet high in smoked foods (nitrosamines), tobacco smoking, achlorhydria, and chronic gastritis.

33. Virchow node (involvement of left supraclavicular node), Krukenberg tumor (bilateral metastases to ovaries), Sister Mary Joseph nodule (subcutaneous periumbilical metastasis), and Blumer shelf (metastasis to pouch of Douglas).

34. Increased; decreased.

35. Diarrhea, steatorrhea, weight loss, weakness, and vitamin and mineral deficiencies.

36. Cystic fibrosis, obstructing cancer, and chronic pancreatitis. A major consequence is malabsorption of fat and the fat-soluble vitamins (A, D, E, and K) as well as B_{12}, leading to deficiency of these vitamins.

37. Anti-endomysial, anti-deamidated gliadin peptide antibodies; IgA anti-tissue transglutaminase; dermatitis herpetiformis.

38.

Characteristic	Crohn Disease	Ulcerative Colitis
Associated with colorectal cancer?	Yes	Yes
Gross morphology	cobblestone mucosa, creeping fat, bowel wall thickening, linear ulcers, fissures	Friable mucosa with superficial and/or deep ulcerations. Loss of haustra
Depth of inflammation	Transmural	Mucosal and submucosal only
Distinguishing complications	Fistulas, phlegmon/abscess, strictures, perianal disease	Fulminant colitis, toxic megacolon, perforation
Granulomas?	Yes	No
Location	Any part of GI tract, typically terminal ileum, then colon	Colon
Rectal involvement	Usually rectal sparing	Always involves rectum

39. McBurney point is one-third the distance from the right anterior superior iliac spine to the umbilicus; pain localized to McBurney point (RLQ) is pathognomonic for appendicitis.

40. This is a typical presentation of diverticulosis, which can present with painless hematochezia.

41. In a false diverticulum, only the mucosa and submucosa outpouch; in a true diverticulum, all three gut wall layers outpouch.

42. Volvulus; intussusception.

43. Adhesions; this is the most common cause of small bowel obstruction.

44. Familial adenomatous polyposis; Gardner syndrome; Turcot syndrome.

45. Loss of APC gene, which is associated with decreased intracellular adhesion and greater proliferation.

46. Portal hypertension can cause hematemesis (esophageal varices), melena (gastric varices), caput medusae, ascites, and hemorrhoids (anorectal varices). Cirrhosis can cause coma, scleral icterus, fetor hepaticus, spider angiomas, gynecomastia, jaundice, testicular atrophy, asterixis, bleeding tendency, anemia, and peripheral edema.

47. Greater than; less than.

48. A-1, B-5, C-4, D-2, E-3, F-6.

49. Biliary atresia

50.

Characteristic	Crigler-Najjar Syndrome, type I	Dubin-Johnson Syndrome	Gilbert Syndrome
Impairment	↑ unconjugated bilirubin	Conjugated hyperbilirubinemia	Bilirubin uptake
Course of disease	Symptomatic; cure is liver transplant	Benign	Benign
Symptoms	Jaundice, kernicterus	Jaundice, black liver	Asymptomatic or mild jaundice

51. Copper; serum ceruloplasmin. Treatment is chelation with penicillamine or trientine, oral zinc. Liver transplant in acute liver failure related to Wilson disease.

52. Hemochromatosis. Iron deposits in the liver can cause cirrhosis, iron in the pancreas can lead to DM, and deposition of hemosiderin in the skin will lead to the hyperpigmentation.

53. Gallstones, biliary strictures, and pancreatic carcinoma.

54. Primary biliary cholangitis and primary sclerosing cholangitis.

55. A-2, B-3, C-1.

56. Serum amylase or lipase.

57. Alcohol abuse and genetic predisposition.

PHARMACOLOGY

58. Cimetidine, ranitidine, famotidine, nizatidine. These are H_2 receptor blockers.

59. Omeprazole, lansoprazole, esomeprazole, pantoprazole, and dexlansoprazole. PPIs are very effective because they irreversibly inhibit H^+/K^+ ATPase in stomach parietal cells, instead of blocking just one of several stimulatory receptors.

60. Preventing NSAID-induced peptic ulcers.

61. Hypokalemia.

62. Ondansetron; 5-HT_3 antagonist.

63. Metoclopramide; parkinsonian effects (because it is a D_2 receptor antagonist).

64. Orlistat inhibits gastric and pancreatic lipase, which results in decreased absorption of dietary fats. Common side effects are: abdominal pain, flatulence, bowel urgency/frequent bowel movements, steatorrhea, and decreased absorption of fat-soluble vitamins.

Endocrine

Questions

EMBRYOLOGY

1. Which structure connects the thyroid gland with the tongue in early embryos? *(p 326)* _____

   _____

2. How can you differentiate a thyroglossal duct cyst from a pharyngeal cleft cyst? *(p 326)* _____

   _____

ANATOMY

3. What are the two divisions of the pituitary gland? List the hormones secreted by each division. *(p 327)* _____

   _____

4. Where are the nuclei that produce the hormones released by the posterior pituitary gland? *(p 327)* _____

   _____

5. What are the three major zones of the adrenal cortex? Name the hormone secreted by each zone. *(p 327)* _____

   _____

PHYSIOLOGY

6. Which two molecules control the secretion of prolactin? Which hormone does prolactin control the secretion of? *(p 328)* _____

_____

7. What is the main function of antidiuretic hormone (vasopressin)? What two receptors does it work on? *(p 329)* _____

_____

_____

8. How do T_3 and T_4 control the body's metabolic rate? *(p 331)* _____

_____

9. What is the difference between thyroxine-binding globulin and thyroglobulin? *(p 331)* _____

_____

10. Where does the inactive form of vitamin D come from? Where do the two hydroxylation steps required to activate vitamin D occur? *(p 332)* _____

11. PTH _____ (increases/decreases) serum calcium levels and _____ (increases/decreases) serum phosphate levels. Vitamin D _____ (increases/decreases) serum calcium level and _____ (increases/decreases) serum phosphate levels. *(p 332)*

12. Which two tissue types have their glucose transport primarily controlled by insulin? By which specific glucose transporter? *(p 334)* _____

13. What test will allow you to distinguish between high endogenous and high exogenous insulin? *(p 334)* _____

14. Fill in the blanks and choose the correct answers to complete the mechanism by which β cells secrete insulin. *(p 334)*

I. Glucose enters the β cell via _____ transporter.
II. Glucose is metabolized, raising intracellular _____.
III. ATP-sensitive _____ channels _____ (open/close), causing _____ (depolarization/hyperpolarization) of the β cell membrane.
IV. Voltage-gated _____ channels _____ (open/close).
V. _____ enters the cell, and stimulates exocytosis of insulin granules into the bloodstream.

15. For each of the congenital adrenal hyperplasias in the chart, indicate whether blood pressure and sex hormone levels are increased or decreased. *(p 335)*

Disease	Blood Pressure	Sex Hormones
11β-hydroxylase deficiency		
17α-hydroxylase deficiency		
21-hydroxylase deficiency		

16. What enzyme catalyzes the conversion of testosterone to estradiol? What enzyme catalyzes the conversion of testosterone to DHT? *(p 335)* _____

17. Describe the regulation of cortisol secretion, including the relevant anatomic locations, cell types, and trophic hormones. *(p 336)* _____

_____

18. Increased levels of sex hormone–binding globulins _____ (increases/decreases) free testosterone levels in men and _____ (increases/decreases) free testosterone levels in women. *(p 337)*

PATHOLOGY

19. How is diabetes insipidus diagnosed? *(p 338)* _____

_____

_____

_____

20. What are the causes of SIADH? *(p 338)* _____

_____

21. What are the differences between DI and SIADH? *(p 338)* _____

_____

22. Compare and contrast the characteristics of hypothyroidism and hyperthyroidism, using the chart below. *(p 340)*

Sign/Symptom	Hypothyroidism	Hyperthyroidism
Activity level		
Bowel movements		
Cardiovascular changes		
Edema		
Free T_3 and T_4		
Hair texture		
Reflexes		
Skin changes		
Cholesterol		
Temperature		
TSH level		
Weight		

23. List five diseases characterized primarily by hypothyroidism. *(p 341)* _____

_____

24. What is the difference between de Quervain thyroiditis and Riedel thyroiditis? *(p 341)* _____

_____

25. List two diseases characterized primarily by hyperthyroidism. *(p 342)* _____

_____

26. Name four types of thyroid cancer. Which is most common? *(p 343)* _____

_____

27. What is the Chvostek sign? *(p 344)* _____

28. Fill in the missing lab values for hypocalcemia in the chart below. *(p 344)*

Disorder	Ca^{2+}	PO_4^{3-}	PTH
Vitamin D deficiency		↓	
Hypoparathyroidism			↓
2° hyperparathyroidism (CKD)	↓		
Pseudohypoparathyroidism		↑	
Hyperphosphatemia			↑

29. Primary hyperparathyroidism is characterized by _____ (increased/decreased) calcium levels and _____ (increased/decreased) alkaline phosphatase, whereas secondary hyperparathyroidism is characterized by _____ (increase/decreased) calcium levels and _____ (increased/decreased) alkaline phosphatase. *(p 345)*

30. What does the mnemonic “stones, thrones, bones, groans, and psychiatric overtones” stand for? *(p 345)* _____

_____

_____

31. What are the acute manifestations of diabetes mellitus types 1 and 2? *(p 346)* _____

_____

32. What are the chronic manifestations of poorly controlled diabetes? *(p 346)* _____

_____

_____

33. Compare and contrast the characteristics of type 1 and type 2 diabetes, using the chart below. *(p 347)*

	Type 1	Type 2
Associated with obesity		
Genetic predisposition		
Glucose intolerance		
Ketoacidosis		
Need for insulin		
Primary defect		
Sensitivity to insulin		
Typical age of onset		

34. How can patients with diabetic ketoacidosis be recognized by their breath? *(p 347)* _____

_____

35. What is the most common cause of Cushing syndrome? *(p 348)* _____

36. For a patient who is not taking steroids, what are other potential causes of Cushing syndrome? *(p 348)* _____

_____

37. What are the common clinical manifestations of Cushing syndrome? *(p 348)* _____

_____

38. How is Cushing syndrome diagnosed? *(p 348)* _____

_____

39. Is hyperkalemia seen in primary or secondary adrenal insufficiency? *(p 349)* _____

40. What are the three common causes of Waterhouse-Friderichsen syndrome? *(p 349)* _____

_____

41. What is the “rule of 10’s” for pheochromocytoma? What is the cell of origin for this tumor? *(p 350)*

_____

_____

42. What are the signs and symptoms of pheochromocytoma? *(p 350)* _____

_____

43. In the chart below, check the components involved in the multiple endocrine neoplasias. *(p 351)*

	MEN 1	MEN 2A	MEN 2B
Pancreas			
Parathyroid			
Pituitary			
Pheochromocytoma			

44. Which tumor is composed of pancreatic α cells, and how does it present? *(p 351)* _____

_____

_____

PHARMACOLOGY

45. Name the three varieties of rapid acting insulin. What is the main use of rapid acting insulin compared to long acting insulin? *(p 352)* _____

_____

_____

46. Among insulin, metformin, sulfonylureas, and glitazones/thiazolidinediones, which can cause hypoglycemia if taken in excess? *(pp 352-353)* _____

_____

47. What is the most feared complication of metformin? Which patients have the highest risk? *(p 353)*

_____

48. Which drugs are used to treat hyperthyroidism? *(p 354)* _____

49. Which drugs are used to treat hypothyroidism? *(p 354)* _____

50. Which drug is used to treat hyperphosphatemia? *(p 355)* _____

Answers

EMBRYOLOGY

1. Thyroglossal duct, which normally disappears, but may persist as cysts or pyramidal lobe of the thyroid.

2. A thyroglossal duct cyst will move with swallowing or protrusion of the tongue whereas a pharyngeal cleft cyst will not.

ANATOMY

3. The posterior pituitary stores and secretes ADH (vasopressin) and oxytocin. The anterior pituitary secretes FSH, LH, ACTH, TSH, prolactin, GH, and β-endorphin. Melanotropin (MSH) is secreted from the intermediate lobe of the pituitary.

4. The supraoptic and paraventricular nuclei synthesize ADH and oxytocin, respectively. They are located in the hypothalamus and transported to posterior pituitary via neurophysins.

5. Zona Glomerulosa produces aldosterone, Zona Fasciculata produces cortisol, and Zona Reticularis produces DHEA.

PHYSIOLOGY

6. Dopamine inhibits prolactin release; TRH may increase prolactin secretion. Prolactin inhibits GnRH, thus delaying postpartum ovulation.

7. ADH's primary function is serum osmolality regulation. It acts at V_2-receptors to increase aquaporin channel insertion in principal cells of renal collecting duct and V_1-receptors on vessels for blood pressure regulation.

8. By increasing Na^+/K^+-ATPase activity, which increases oxygen consumption, respiratory rate, and body temperature.

9. Thyroid-binding globulin is a transport protein that binds T4 and T3 in the bloodstream (because they're lipophilic). Thyroglobulin is a large precursor molecule synthesized by thyroid follicles that is used to generate multiple T4 and T3 molecules.

10. Inactive Vitamin D is absorbed from the diet or is synthesized in the skin when exposed to sunlight. Activation of Vitamin D requires hydroxylation in the liver, then the kidney.

11. Increases; decreases; increases; increases.

12. Striated (skeletal) muscle and adipose tissue; by the GLUT4 transporter.

13. C-peptide is absent if the source of insulin is exogenous and present in high levels if the patient has an insulinoma or in sulfonylurea use.

14.

I. Glucose enters the β cell via **GLUT-2** transporter.

II. Glucose is metabolized, raising intracellular **ATP**.

III. ATP-sensitive **potassium** channels **close**, causing **depolarization** of the β cell membrane.

IV. Voltage-gated **calcium** channels **open.**

V. **Calcium** enters the cell, and stimulates exocytosis of insulin granules into the bloodstream.

15.

Disease	Blood Pressure	Sex Hormones
11β-hydroxylase deficiency	↑	↑
17α-hydroxylase deficiency	↑	↓
21-hydroxylase deficiency	↓	↑

16. Aromatase; 5α-reductase.

17. CRH (hypothalamus) stimulates release of ACTH in anterior pituitary, which prompts cortisol production in the zona fasciculata in the adrenal cortex.

18. Decreases; decreases.

PATHOLOGY

19. Water deprivation test: No water for 2-3 hours followed by hourly measurements of urine volume and osmolality as well as plasma NA^+ concentration and osmolality. ADH analog (desmopressin) is administered if serum osmolality > 295–300 mOsm/kg, plasma Na+ ≥ 145 mEq/L, or urine osmolality does not rise despite a rising plasma osmolality. Response to desmopressin can distinguish between central and nephrogenic DI.

20. Ectopic ADH (eg, small cell lung cancer), CNS disorder/head trauma, pulmonary disease, and drugs eg, SSRIs, carbamazepine, cyclophosphamide.

21. DI denotes lack of ADH; SIADH denotes too much ADH. DI is characterized by intense thirst and polyuria, with high serum osmolarity and poorly concentrated urine. SI ADH is characterized by excessive water retention, with high urine osmolarity and low serum osmolarity.

22.

Sign/Symptom	Hypothyroidism	Hyperthyroidism
Activity level	Hypoactivity	Hyperactivity
Bowel movements	Constipation	Diarrhea
Cardiovascular changes	Bradycardia; dyspnea on exertion	Tachycardia, chest pain, palpitations, dyspnea, arrhythmias, systolic HTN
Edema	Myxedema, periorbital edema	Pretibial myxedema
Free T_3 and T_4	↓	↑
Hair texture	Coarse, brittle	Fine
Reflexes	↓	↑
Skin changes	Dry, cool skin	Warm, most skin
Cholesterol	Hypercholesterolemia	↓ LDL, HDL, and total cholesterol
Temperature	Cold intolerance	Heat intolerance
TSH level	↑ (if primary)	↓ (if primary)
Weight	Weight gain (low appetite)	Weight loss (high appetite)

23. Hashimoto thyroiditis, postpartum thyroiditis, congenital hypothyroidism (cretinism), subacute granulomatous thyroiditis (de Quervain), and Riedel thyroiditis.

24. de Quervain (subacute) thyroiditis is a self-limited type of hypothyroidism that often follows a flu-like illness (eg, viral infection). In Riedel thyroiditis, the thyroid is replaced by fibrous tissue and inflammatory infiltrate.

25. Graves disease, toxic multinodular goiter, thyroid storm (uncommon but serious complication), and Jod-Basedow phenomenon (iodine-induced hyperthyroidism).

26. Papillary carcinoma (most common); follicular, medullary, and undifferentiated/anaplastic carcinomas.

27. In hypoparathyroid patients, tapping of the facial nerve causes the facial muscles to contract.

28.

Disorder	Ca^{2+}	PO_4^{3-}	PTH
Vitamin D deficiency	↓	↓	↑
Hypoparathyroidism	↓	↑	↓
2° hyperparathyroidism (CKD)	↓	↑	↑
Pseudohypoparathyroidism	↓	↑	↑
Hyperphosphatemia	↓	↑	↑

29. Increased; increased; decreased; increased.

30. Renal calcium **stones**, polyuria (**thrones**), osteitis fibrosa cystica of **bones**, neuropsychiatric disturbances ("**psychiatric overtones**"), and abdominal complaints ("**groans"** due to constipation).

31. Polydipsia, polyuria, polyphagia, weight loss, DKA (type 1), and hyperosmolar hyperglycemic state (type 2).

32. Small vessel disease, retinopathy, glaucoma, cataracts, nephropathy, nodular glomerulosclerosis, progressive proteinuria, arteriosclerosis, hypertension, chronic kidney disease, large vessel atherosclerosis, CAD, peripheral vascular occlusive disease, osmotic damage, neuropathy, and gangrene.

33.

	Type 1	Type 2
Associated with obesity	No	Yes
Genetic predisposition	Weak (50% concordance in identical twins)	Strong (90% concordance in identical twins), polygenic
Glucose intolerance	Severe	Mild to moderate
Ketoacidosis	Common	Rare
Need for insulin	Always	Sometimes
Primary defect	Autoimmune T-cell mediated destruction of β cells	Increased resistance to insulin, progressive pancreatic β-cell failure
Sensitivity to insulin	High	Low
Typical age of onset	< 30 years	> 40 years

34. Increased ketogenesis results in accumulation of acetone and other ketones; when exhaled, acetone gives breath a fruity odor.

35. Exogenous corticosteroids.

36. ACTH-secreting pituitary adenoma (Cushing disease); paraneoplastic ACTH secretion (eg, small cell lung cancer, bronchial carcinoids); bilateral adrenal hyperplasia. Cushing disease is responsible for the majority of endogenous cases of Cushing syndrome.

37. Weight gain, truncal obesity, moon facies, buffalo hump, skin changes (eg, thinning, striae), hirsutism, hypertension, hyperglycemia, osteoporosis, amenorrhea, and immunosuppression.

38. Screening tests include: ↑ free cortisol on 24-hr urinalysis, ↑ late night salivary cortisol, and no suppression with overnight low-dose dexamethasone test.

39. Primary adrenal insufficiency.

40. Adrenal hemorrhage associated with septicemia (usually due to *N meningitidis*), DIC, and endotoxic shock.

26. Recurrent diarrhea, wheezing, right-sided valvular heart disease, and niacin deficiency.

41. 10% are malignant, 10% are bilateral, 10% are extra-adrenal (eg, bladder wall, organ of Zuckerkandl), 10% calcify, and 10% occur in kids. Chromaffin cells are the cells of origin for pheochromocytoma.

42. Elevated blood **P**ressure, **P**ain (headache), **P**erspiration, **P**alpitations (tachycardia), and **P**allor. These "**5 P's**" are episodic hyperadrenergic symptoms.

43.

	MEN 1	MEN 2A	MEN 2B
Pancreas	√		
Parathyroid	√	√	
Pituitary	√		
Pheochromocytoma		√	√

44. Glucagonoma, which presents with six **D**'s: **D**ermatitis (necrolytic migratory erythema), **D**iabetes (hyperglycemia), **D**VT, **D**eclining weight, **D**epression, and **D**iarrhea.

PHARMACOLOGY

45. Lispro, aspart, and glulisine (no LAG). Unlike long acting insulin, which is used to maintain a normal basal insulin level, rapid acting insulin is taken with meals to address elevated postprandial glucose.

46. Insulin and sulfonylureas can cause hypoglycemia if taken in excess.

47. Lactic acidosis, especially in patients with renal insufficiency.

48. Thionamides: propylthiouracil and methimazole.

49. Levothyroxine and liothyronine.

50. Sevelamer.

Hematology and Oncology

Questions

EMBRYOLOGY

1. Why are Rh-negative mothers given anti-D IgG? *(p 405)* _____

_____

ANATOMY

2. What conditions can cause hyper-segmentation of neutrophils? *(p 406)* _____

_____

3. Define the following terms. *(p 407)*

   A. Anisocytosis _____

   B. Poikilocytosis _____

   C. Reticulocyte _____

4. What do the dense granules of platelets contain? *(p 407)* _____

_____

5. What do the α-granules of platelets contain? *(p 407)* _____

_____

6. CD14 is a cell surface marker for which cell type? *(p 407)* _____

7. What seven conditions can cause eosinophilia? *(p 408)* _____

_____

8. What do basophilic granules contain? Which molecules are synthesized and released by basophils? *(p 408)* _____

_____

9. B cells originate from stem cells in the _____ (bone marrow/thymus) and mature in the _____ (bone marrow/thymus). T cells originate from stem cells in the _____ (bone marrow/thymus) and mature in the _____ (bone marrow/thymus). *(p 409)*

10. What type of cell has an eccentric nucleus, abundant RER, and a clock-face chromatin distribution? *(p 409)* _____

11. Which lymphocytes are larger than B and T cells and can distinguish between healthy and infected cells by identifying cell surface proteins? *(p 409)* _____

PHYSIOLOGY

12. Describe the four steps of platelet plug formation (primary hemostasis). *(p 411)*

_____

_____

_____

_____

_____

_____

13. In the chart below, indicate the pathway(s) for each coagulation factor. *(p 412)*

Factor	Extrinsic Pathway	Intrinsic Pathway	Combined (Common) Pathway
I			
II			
V			
VII			
VIII			
IX			
X			
XI			
XII			

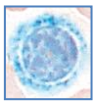
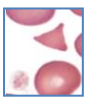
14. Which factors are vitamin K dependent? How does warfarin inhibit the activation of these factors?

(p 413) _____

_____

PATHOLOGY

15. Identify each cell type and its associated pathology. *(pp 414-416)*

A.  B.  C.  D.  E.  F. 

A. _____ D. _____

B. _____ E. _____

C. _____ F. _____

16. What does reticulocyte index (RI) measure? What do high RI and low RI each indicate? *(p 417)*

_____

_____

17. In α-thalassemia, what is the condition called when all four α-globin genes are deleted? When three are deleted? When two are deleted? When one is deleted? *(p 418)* _____

_____

_____

18. Indicate whether the iron studies in the chart are elevated, decreased, or normal. *(p 419)*

Lab Value	Chronic Disease	Iron Deficiency	Pregnancy/ OCP use	Hemochromatosis
Ferritin				
Serum iron				
Transferrin or TIBC				
% Transferrin saturation				

19. What clinical manifestations do folate deficiency and vitamin B_{12} deficiency have in common? What sets them apart? *(p 420)* _____

_____

20. What are four causes of aplastic anemia? *(p 421)* _____

_____

21. Match the intrinsic hemolytic normocytic anemia with its characteristic. *(p 422)*

_____ A. G6PD deficiency	1. GLU → LYS mutation
_____ B. HbC disease	2. HbS point (GLU → VAL) mutation
_____ C. Hereditary spherocytosis	3. Heinz bodies and bite cells
_____ D. Paroxysmal nocturnal hemoglobinuria	4. Associated with aplastic anemia & acute leukemias
_____ E. Pyruvate kinase deficiency	5. Increased fragility in osmotic fragility test
_____ F. Sickle cell anemia	6. Rigid RBCs

22. Which autoimmune hemolytic anemias are warm and which are cold? *(p 423)* _____

_____

_____

23. In lead poisoning what enzymes are affected and what substrates are accumulated? *(p 425)* ____

_____

24. What are the “5 P’s” of acute intermittent porphyria? *(p 425)* _____

_____

_____

25. Indicate whether the lab findings for the coagulation or platelet disorders in the chart are elevated, decreased, or normal. *(pp 426-427)*

Disorder	Platelet Count	Bleeding Time	PT	PTT
Disseminated Intravascular Coagulation (DIC)				
Glanzmann thrombasthenia				
Hemophilia A, B, or C				
Thrombotic thrombocytopenic purpura (TTP)				
Vitamin K deficiency				
von Willebrand disease				

26. Which symptoms of Thrombotic thrombocytopenic purpura and Hemolytic-uremic syndrome overlap? What are the differentiating symptoms? How is each treated? Which demographics do each typically affect? *(p 427)* _____

_____

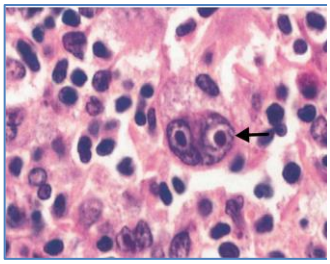
_____

_____

27. Which type of Hodgkin lymphoma is most common? *(p 429)* _____

_____

28. What type of cell is shown by the arrow in the image?
In what condition is this cell seen? *(p 429)*



_____

_____

_____

29. What are the clinical manifestations of multiple myeloma? *(p 431)* _____

_____

30. What will serum protein electrophoresis reveal in a patient with multiple myeloma? What will be seen in the urine? *(p 431)* _____

_____

31. What are the four major groups of leukemia? Which type is at risk for DIC upon initiation of treatment and why? *(pp 432-433)* _____

_____

_____

32. Indicate whether the lab findings in the chart are elevated, decreased, or normal. *(p 433)*

Chronic Myeloproliferative Disorder	Platelets	RBCs	WBCs
CML			
Essential thrombocythemia			
Myelofibrosis			
Polycythemia vera			

33. Match the disease with the genetic translocation most closely associated with it. *(p 434)*

_____ A. Acute myelogenous leukemia
_____ B. Burkitt lymphoma
_____ C. Chronic myelogenous leukemia
_____ D. Follicular lymphoma
_____ E. Mantle cell lymphoma

1. t(8;14)
2. t(9;22)
3. t(11;14)
4. t(14;18)
5. t(15;17)

PHARMACOLOGY

34. A patient presents with fever, pancytopenia, and hepatosplenomegaly. The bone marrow biopsy shows macrophages phagocytosing marrow elements. What is the likely diagnosis? *(p 435)* _____

_____

35. What is the mechanism of action of heparin? How is overdose treated? *(p 436)* _____

_____

36. What is the mechanism of action of warfarin? How is overdose treated? *(p 436)* _____

_____

37. Match each drug with its target. *(pp 437-438, 440-443)*

_____ A. Abciximab	1. ADP ($P2Y_{12}$) receptor
_____ B. Clopidogrel	2. CD20, found on B-cell neoplasms
_____ C. Etoposide	3. tyrosine kinase inhibitor of *bcr-abl*
_____ D. 5-Fluorouracil	4. Estrogen receptor
_____ E. Imatinib	5. Glycoprotein receptor IIb/IIIa
_____ F. Rituximab	6. HER-2 (*c-erbB2*)
_____ G. Tamoxifen	7. Plasminogen
_____ H. TNK-tPA	8. Thymidylate synthase
_____ I. Trastuzumab	9. Topoisomerase II
_____ J. Vincristine	10. β-tubulin

38. Match the patient with the drug he or she is most likely taking. *(pp 439-441)*

_____ A. Patient with previous bone marrow transplantation has PFTs consistent with restrictive lung disease

_____ B. Patient with colon cancer has myelosuppression not reversible with leucovorin

_____ C. Patient with leukemia has myelosuppression, reversible with leucovorin

_____ D. Patient with non-Hodgkin lymphoma has hemorrhagic cystitis

_____ E. Patient with solid tumor has dilated cardiomyopathy

_____ F. Patient with testicular cancer has PFTs consistent with restrictive lung disease

1. Bleomycin
2. Busulfan
3. Cyclophosphamide
4. Doxorubicin
5. 5-Fluorouracil
6. Methotrexate

Answers

EMBRYOLOGY

1. To prevent anti-D IgG formation, which can cause hemolytic disease of the newborn (erythroblastosis fetalis) in a subsequent fetus.

ANATOMY

2. Vitamin B_{12} and folate deficiency.

3. A. Anisocytosis: Cells vary in size.

   B. Poikilocytosis: Cells vary in shape.

   C. Reticulocyte: Immature RBCs; reflects erythroid proliferation.

4. **C**alcium, **A**DP, **s**erotonin, and **h**istamine. Remember **CASH**.

5. von Willebrand factor (vWF), fibrinogen, fibronectin, and platelet factor 4.

6. Macrophages.

7. **P**arasites, **a**sthma, **C**hurg-Strauss syndrome, **c**hronic adrenal insufficiency, **m**yeloproliferative disorders, **a**llergic processes, and **n**eoplasia (eg, Hodgkin lymphoma). Remember **PACCMAN**.

8. Basophilic granules contain histamine and heparin. They synthesize and release leukotrienes.

9. Bone marrow; bone marrow; bone marrow; thymus.

10. Plasma cell.

11. Natural killer cells.

PHYSIOLOGY

12. **1. Injury:** Endothelial damage occurs.

2. Exposure: vWF binds to exposed collagen**.**

3. Adhesion: Platelets bind vWF via the GpIb receptor at the site of injury and release ADP, Ca^{2+}, and TXA_2. ADP helps platelets adhere to endothelium.

4A. Activation: ADP binding to $P2Y_{12}$ receptor induces GpIIb/IIIa expression at platelet surface.

4B. Aggregation: Fibrinogen binds GpIIb/IIIa receptors and links platelets.

13.

Factor	Extrinsic Pathway	Intrinsic Pathway	Combined (Common) Pathway
I			√
II			√
V			√
VII	√		
VIII		√	
IX		√	
X			√
XI		√	
XII		√	

14. Factors II, VII, IX, X, and proteins C and S. Warfarin inhibits vitamin K epoxide reductase, which is necessary to convert vitamin K to its reduced form so that it can activate these factors.

PATHOLOGY

15. A = Degmacyte (bite cell): G6PD deficiency.

    B = Iron granules found in ringed sideroblasts: sideroblastic anemias.

    C = Schistocyte: microangiopathic hemolytic anemias (MAHAs) including DIC, TTP/HUS, HELLP syndrome; mechanical hemolysis.

    D = Dacrocyte (teardrop cell): bone marrow infiltration (eg, myelofibrosis), thalassemias.

    E = Target cell: HbC disease, asplenia, liver disease, thalassemia.

    F = Heinz bodies: G6PD deficiency.

16. Reticulocyte index (RI) measures appropriate bone marrow response to anemic conditions (effective erythropoiesis) by mathematically correcting the reticulocyte count. High RI indicates compensatory RBC production; low RI indicates inadequate response to correct anemia.

17. Four deletions: Hemoglobin Barts disease; three deletions: Hemoglobin H disease (HbH); two deletions: α-thalassemia minor; one deletion: α-thalassemia minima.

18.

Lab Value	Chronic Disease	Iron Deficiency	Pregnancy/ OCP use	Hemochromatosis
Ferritin	↑	↓	Normal	↑
Serum iron	↓	↓	Normal	↑
Transferrin or TIBC	↓	↑	↑	↓
% Transferrin saturation	Normal/ ↓	↓↓	↓	↑↑

19. Both folic acid and vitamin B_{12} deficiency can cause megaloblastic anemia. Only vitamin B_{12} deficiency is associated with neurologic symptoms, such as reversible dementia and subacute combined degeneration. B_{12} deficiency is also associated with increased methylmalonic acid, unlike folic acid deficiency.

20. Idiopathic, radiation and drug exposure (eg, benzene, chloramphenicol, alkylating agents, antimetabolites), viral agents (eg, EBV, HIV, hepatitis viruses), and Fanconi anemia.

21. A-3, B-1, C-5, D-4, E-6, F-2.

22. **Warm** AIHA: chronic anemia in which Ig**G** causes RBC agglutination; seen in SLE and chronic lymphocytic leukemia (CLL) with certain drugs. Remember: "**Warm** weather is **g**ood." Cold AIHA: acute anemia in which Ig**M** + complement causes RBC agglutination upon exposure to cold; seen in CLL, ***M****ycoplasma pneumonia*e infections, and infectious **m**ononucleosis.

23. Enzymes: Ferrochelatase and ALA dehydratase. Substrates: Protoporphyrin and ALA (blood)

24. **P**ainful abdomen, **P**ort wine-colored urine, **P**olyneuropathy, **P**sychological disturbances, and **P**recipitated by drugs (eg, cytochrome P-450 inducers), alcohol, and starvation.

25.

Disorder	Platelet Count	Bleeding Time	PT	PTT
Disseminated Intravascular Coagulation (DIC)	↓	↑	↑	↑
Glanzmann thrombasthenia	normal	↑	normal	normal
Hemophilia A, B, or C	normal	normal	normal	↑
Thrombotic thrombocytopenic purpura (TTP)	↓	↑	normal	normal
Vitamin K deficiency	normal	normal	↑	↑
von Willebrand disease	normal	↑	normal	normal / ↑

26. Both disorders present with a triad of thrombocytopenia (↓ platelets), microangiopathic hemolytic anemia (↓ Hb, schistocytes, ↑ LDH), acute kidney injury (↑ Cr). TTP presents with the triad, fever, and **neurologic symptoms**, whereas HUS presents with the triad and **bloody diarrhea**. The treatment for TTP is plasmapheresis, steroids, and rituximab; for HUS, it is supportive care. TTP typically affects young females and HUS typically affects children.

27. Nodular sclerosis.

28. Reed-Sternberg cell; Hodgkin lymphoma.

29. Multiple Myeloma is clinically identified by **CRAB** findings: hyper**C**alcemia, **R**enal failure, **A**nemia, and **B**one osteolytic lesions.

30. An M-spike, representing an overproduction of a monoclonal Ig fragment; Ig light chains in urine (Bence Jones proteinuria).

31. AML, ALL, CML, and CLL. AML can present with DIC upon initiation of treatment because the leukemia cells contain Auer rods composed of the enzyme myeloperoxidase, which is released into the bloodstream when treatment causes cells to lyse.

32.

Chronic Myeloproliferative Disorder	Platelets	RBCs	WBCs
CML	↑	↓	↑
Essential thrombocythemia	↑	—	—
Myelofibrosis	variable	↓	variable
Polycythemia vera	↑	↑	↑

33. A-5, B-1, C-2, D-4, E-3.

PHARMACOLOGY

34. Hemophagocytic lymphohistiocytosis, which is a systemic overactivation of macrophages and cytotoxic T cells.

35. Heparin activates antithrombin, decreasing action of IIa (thrombin) and factor Xa. Treat heparin overdose with protamine sulfate.

36. Warfarin inhibits epoxide reductase, which interferes with γ-carboxylation of vitamin K-dependent clotting factors II, VII, IX, X, and proteins C, and S. Treat warfarin overdose with vitamin K; for rapid reversal, treat with fresh frozen plasma or PCC.

37. A-5, B-1, C-9, D-8, E-3, F-2, G-4, H-7, I-6, J-10.

38. A-2, B-5, C-6, D-3, E-4, F-1.

Microbiology

Questions

BASIC BACTERIOLOGY

1. Which structure of the bacterial cell wall protects against phagocytosis? *(p 124)* _____

2. Which feature of the cytoplasmic membrane is unique to gram-positive organisms? Which feature of the outer membrane is unique to gram-negative organisms? *(p 124)* _____

_____

_____

3. What feature of the cell wall makes it possible for an acid-fast stain to identify *Mycobacteria* and some *Nocardia* species? *(p 125)* _____

4. Which bacterial species demonstrate limitations with Gram-staining? How can some of these species be identified? *(pp 125, 146)* _____

_____

_____

_____

5. A 19-year-old Asian immigrant comes to the clinic because of blood in his sputum. He says that he has been losing weight and having night sweats. The patient has a fever, and physical examination reveals bronchial breath sounds with rales. Laboratory tests show lymphocytosis and an increased erythrocyte sedimentation rate. X-ray of the chest shows a calcified lung lesion and hilar lymphadenopathy. A sputum sample is obtained. Which stain should be used to identify the most likely infectious organism? *(pp 125, 140)*

    A. Silver
    B. Giemsa
    C. India ink
    D. Periodic acid-Schiff
    E. Ziehl-Neelsen

6. What are the unique staining and culture requirements of fungi? *(pp 125-126)* _____

    _____

7. Which culture medium would you use to identify the gram-negative organism responsible for producing dysuria and urethral discharge in a patient? *(p 126)* _____

8. Name three clinically important encapsulated bacteria against which vaccines exist. (*p 127)* _____

    _____

    _____

9. Group A streptococci produce _____, which helps them avoid phagocytosis. *(p 129)*

10. The transfer of DNA from one bacterium to another through viruses is known as _____. *(p 130)*

11. The transfer and expression of newly transferred genes is known as _____. *(p 130)*

12. Transferring genetic information from one bacterium to another in the form of plasmids is known as _____. *(p 130)*

13. Most exotoxins are heat-_____ (stable/labile), have _____ (high/low) toxicity, and _____ (can/cannot) be vaccinated against. Endotoxins are heat-_____ (stable/labile), have _____ (high/low) toxicity, and _____ (can/cannot) be vaccinated against. *(p 131)*

14. Endotoxins are made of _____ and induce the cytokines _____, _____, and _____. *(p 131)*

15. Which four bacteria produce toxins that induce cAMP? *(p 132)* _____

_____

CLINICAL BACTERIOLOGY

16. Which organism is a gram-positive, catalase-positive, coagulase-positive cocci in clusters? *(p 135)*

_____

17. How have MRSA developed their resistance to antibiotics? *(p 135)* _____

_____

18. An 85-year-old woman presents from a home with fever, chills, pleuritic pain, and rusty sputum. Physical examination reveals bronchial breath sounds over the right lower lobe with dullness to percussion, and increased tactile fremitus without tracheal deviation. The patient's respiratory distress worsens until she is intubated and admitted to the intensive care unit, where she dies. Which organism is the most likely culprit? *(p 136)*

    A. *Chlamydia pneumonia*
    B. *Klebsiella pneumoniae*
    C. *Mycoplasma pneumonia*
    D. *Staphylococcus aureus*
    E. *Streptococcus pneumoniae*

19. A 12-year-old boy is experiencing pain localized to the joints of the extremities. The mother recalls that he had a sore throat about a month earlier, but recovered completely without medical attention. Which of the following is the most likely etiology? *(p 136)*

    A. Calcification of a thickened mitral valve
    B. Degeneration of synovial joints
    C. Hepatic failure
    D. Kidney failure
    E. Rheumatic fever

20. a) A 76-year-old man is hospitalized because of acute exacerbation of chronic obstructive pulmonary disease. After 5 days in the hospital, he develops a fever. Urine cultures show enterococci. An antibiotic is administered, and 10 days later the patient experiences watery stools. Cytotoxic assay of stool culture shows *Clostridioides difficile*. Which antibiotic was most likely administered to treat the *Enterococcus* infection? *(p 138)*

    A. Ampicillin
    B. Ciprofloxacin
    C. Daptomycin
    D. Metronidazole
    E. Trimethoprim-sulfamethoxazole

    b) Which of these antibiotics (A-E) could you administer to treat the *C difficile* infection? _____

    c) What are the other commonly used antibiotic agents used to treat *C difficile* infection? _____

21. *Actinomyces* is a gram-positive _____ (aerobe/anaerobe) that causes _____, whereas *Nocardia* is a gram-positive _____ (aerobe/anaerobe) that causes _____. Both have a _____ structure. *(p 139)*

22. What does a positive PPD skin test for tuberculosis indicate? *(p 140)* _____

    _____

23. a) Five soldiers living in the same military barrack present to the infirmary with high fever, headache, stiff neck, and a rash on the trunk. CSF analysis shows increased PMN, decreased glucose, and increased protein concentration. Gram stain is expected to show which of the following? *(p 142)*

    A. Gram-negative bacilli

    B. Gram-negative diplococci

    C. Gram-negative coccobacilli

    b) Antibiotic prophylaxis of close contacts should be initiated with which of the following agents?

    A. Amoxicillin

    B. Gentamicin

    C. Rifampin

    D. Vancomycin

24. Which gram-negative, aerobic bacillus is increasingly associated with resistant hospital-acquired infections, especially in the ICU? *(p 142)* _____

25. A 4-year-old boy is brought to a rural clinic. He has a two-day history of intense coughing spells that last 1-2 minutes and end with a loud gasp when he inhales. The patient's mother mentions that he has had episodes of vomiting after the coughing spells. She also notes that he had a cold about two weeks earlier and that he has not received any immunizations. Laboratory tests show a WBC count of 22,000/mm^3 with 60% lymphocytes. The rest of the work-up (including x-ray of the chest) is unremarkable. Which organism is the most likely culprit? *(pp 143, 186)*

    A. *Bordetella pertussis*

    B. *Clostridium botulinum*

    C. *Corynebacterium diphtheriae*

    D. *Staphylococcus aureus*

    E. *Vibrio cholerae*

26. Public-health investigators looking into several cases of pneumonia that have occurred in a community are able to trace the outbreak to a water-mist machine used in the produce section of a supermarket. Patients exposed to the water-mist machine have presented with cough, fever, headache, and abdominal pain. Which organism is most likely responsible for this outbreak? *(p 143, 185)*

    A. *Haemophilus influenzae* type B

    B. *Legionella pneumophila*

    C. *Mycobacterium tuberculosis*

    D. *Streptococcus pneumoniae*

27. A patient presents with night sweats, joint pain, and undulant fever. During the physical exam, the patient mentions that he recently tried unpasteurized milk. What is the likely pathogen and how should the patient be treated? *(p 143)* _____

    _____

28. Which is more virulent, *Salmonella* or *Shigella*? Which bacterium has a toxin similar to the one found in this bacterium? *(pp 144-145)* _____

29. What are three virulence factors for *Escherichia coli* and with what pathologies are they associated? *(p 145)* _____

    _____

30. A 28-year-old man presents to his physician with worsening muscle weakness that began in his legs and feet three days earlier, but now involves his arms and hands. Other than having bloody diarrhea two weeks earlier, the patient has been in good health. CSF analysis shows a highly elevated protein level, a normal cell count, and a normal glucose level. An infection with which organism is associated with this patient's neurologic symptoms? *(p 145)*

    A. *Campylobacter jejuni*

    B. *Candida albic*ans

    C. *Pseudomonas aeruginosa*

    D. *Streptococcus pneumoniae*

    E. *Streptococcus pyogenes*

31. What are the signs and symptoms of the three stages of syphilis? *(p 147)* _____

_____

_____

32. What is an Argyll Robertson pupil? What condition is it associated with? *(p 147)* _____

_____

33. What is a Jarisch-Herxheimer reaction? What causes it? *(p 148*) _____

_____

_____

34. What is the appearance of *Gardnerella vaginalis* under a microscope? *(p 148)* _____

_____

35. Which zoonotic bacteria are transmitted by tick bites? *(p 149)* _____

_____

_____

36. How do the rashes of Rocky Mountain spotted fever and typhus differ? *(p 150)*

_____

_____

MYCOLOGY

37. Match the four fungi that cause systemic disease resembling tuberculosis with the area(s) to which they are endemic. *(p 151)*

_____ A. *Blastomycosis*	1. Eastern and Central US, Great Lakes
_____ B. *Coccidioidomycosis*	2. Mississippi and Ohio River Valleys
_____ C. *Histoplasmosis*	3. Latin America
_____ D. *Paracoccidioidomycosis*	4. Southwestern US, California

38. An African-American teenager presents to the clinic in June with patches of skin on her face that are white and hypopigmented. Laboratory tests show a "spaghetti and meatball" appearance on microscopy. What is the most likely diagnosis? *(p 152)* _____

_____

39. What are six ways that *Candida albicans* infection can manifest? *(p 153)* _____

_____

_____

40. A 57-year-old male is admitted with diabetic ketoacidosis. On day 3 of hospitalization, he develops facial pain and swelling. Biopsy of nasal mucosa shows irregular, broad, nonseptate hyphae branching at wide angles. What is the most likely organism, and what is the treatment? *(p 153)*

_____

_____

41. A 35-year-old man who is an HIV-positive, long-term abuser of intravenous drugs presents to the emergency department with a cough and fever. X-ray of the chest shows diffuse bilateral interstitial infiltrates. Histologic analysis of induced sputum is likely to show trophozoite forms of which fungus? *(p 154)* _____

_____

PARASITOLOGY

42. Which protozoa are most likely to cause gastrointestinal infections? Which are most likely to cause visceral infections? Of the protozoa that cause gastrointestinal infections, which tends to cause fatty diarrhea? Which causes bloody diarrhea? Which causes watery diarrhea? *(pp 155, 158)*

_____

_____

_____

43. Specify the common treatment(s) for each protozoan disease. (One number is used twice.) *(pp 155-158)*

_____ A.	*Giardia lamblia*	1.	Amphotericin B, sodium stibogluconate
_____ B.	*Leishmania* spp.	2.	Chloroquine
_____ C.	*Plasmodium falciparum*	3.	Metronidazole
_____ D.	*Toxoplasma gondii*	4.	Benznidazole or nifurtimox
_____ E.	*Trichomonas vaginalis*	5.	Sulfadiazine + pyrimethamine
_____ F.	*Trypanosoma cruzi*		

44. Which two *Plasmodium* species should be treated with primaquine? Why? *(p 157)* _____

_____

45. A patient presents with trouble breathing, chest pain, dysphagia, and weight loss. CT scan demonstrates a dilated esophagus. Which protozoan species is the most likely cause? *(p 158)*

_____

_____

46. a) A 22-year old female presents to the physician complaining of vaginal itching and burning. Examination reveals greenish discharge which is examined under a microscope and reveals motile trophozoites. What is the diagnosis? *(pp 158, 195)* _____

b) What is the treatment? _____

_____

47. Name five nematodes that are ingested by the human host. *(p 159)* _____

_____

48. Name three worms that penetrate into the human host through the skin. *(p 159)* _____

_____

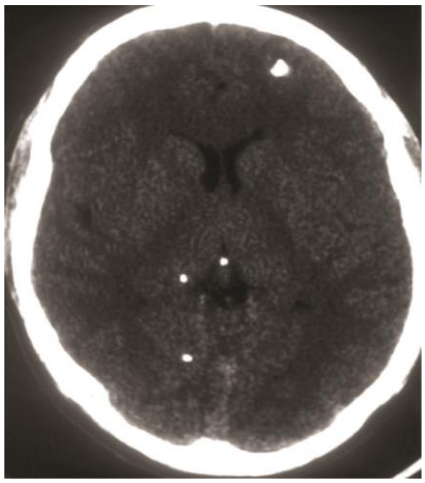
49. What drugs are used to treat intestinal nematode disease? Which drug is used to treat disease caused by trematodes? *(pp 159-160)* _____

_____

50. Specify the common treatment(s) for each helminthic disease. (Numbers may be used more than once.) *(pp 159-160)*

_____ A.	*Ascaris lumbricoides*	1.	Bendazoles
_____ B.	*Diphyllobothrium latum*	2.	Bendazoles or pyrantel pamoate
_____ C.	*Enterobius vermicularis*	3.	Ivermectin
_____ D.	*Onchocerca volvulus*	4.	Praziquantel
_____ E.	*Schistosoma*		
_____ F.	*Taenia solium*		

51. A 66-year-old woman who recently emigrated from Mexico comes to the clinic because she has begun to have seizures. MRI of the brain is shown in the image below. What is the most likely diagnosis? *(p 160)*



A. *Diphyllobothrium latum* infection
B. *Echinococcus granulosus* infection
C. *Onchocerca volvulus* infection
D. *Taenia solium* infection
E. *Wuchereria bancrofti* infection

52. Which helminth is associated with squamous cell bladder cancer? *(p 160)* _____

VIROLOGY

53. Most DNA viruses replicate in the _____ (cytoplasm/nucleus), while most RNA viruses replicate in the _____ (cytoplasm/nucleus). *(pp 163, 167)*

54. a) A 4-year-old child is brought to his physician's office because of a parvovirus infection. Which sign or symptom is most likely to be seen? *(pp 164, 183)*

A. Barking cough
B. Erythema of cheeks
C. Parotid gland swelling
D. Upper respiratory infection
E. Vesicular rash that appears in crops

b) Why should pregnant women avoid this child? _____

_____

c) What symptoms do adults have when infected with parvovirus B19? _____

_____

55. A homeless 37-year-old woman with HIV infection comes to the clinic with a four-week history of worsening hemiparesis, visual field deficits, and cognitive impairment. She has gone two years without antiretroviral therapy and her CD4+ count is 22/mm^3. MRI shows several hyperintensities on T_2-weighted images that do not enhance with contrast and are not surrounded by edema. CSF analysis shows a normal opening pressure, a mildly elevated protein level, and the presence of myelin basic protein, with a mild mononuclear pleocytosis. What is the most likely cause? *(pp 164, 177)*

A. Cortical tuberculoma
B. Cytomegalovirus encephalitis
C. JC virus
D. Primary CNS lymphoma
E. Toxoplasmosis

56. In the pathology lab, you see an infected cell with an “owl eye” inclusion body. This cell is infected with which herpesvirus? *(p 165)* _____

_____

57. A 6-year-old boy is brought to the emergency department by his parents after returning from a trip to East Africa. The parents report that approximately two weeks earlier, the patient had a fever and diarrhea that resolved. However, he now has a fever and weakness of his left leg. On further questioning, his parents state that he is home-schooled and has never received vaccinations. Which sequela is most likely to occur in this patient? *(pp 167-168, 186)*

A. Neuron loss in posterior horns
B. Respiratory muscle paralysis
C. Sensory loss in affected limbs
D. Short-term memory loss

58. Which RNA virus can cause fatal diarrhea in children? _____ This virus has _____ (single-/double-) stranded, _____ (circular/linear/segmented) _____ (DNA/RNA). *(pp 167-168)*

59. a) A family who recently emigrated from Romania brings their 7-year-old son to the clinic because of conjunctivitis and periorbital swelling. The child has been coughing, had a runny nose, and high fever for three days. Physical examination reveals small lesions with blue-white centers in his oral cavity. What is the most likely cause of his symptoms? *(p 170)*

    A. Diphtheria
    B. Pertussis
    C. Roseola
    D. Rubella
    E. Measles

    b) What is the name of the lesions with blue-white centers in the oral cavity? _____

    _____

60. A 17-year-old boy comes to the office complaining of fever and painful, swollen cheeks. He says one of his relatives had a similar illness several weeks earlier. He finds it difficult to talk, eat, and swallow. Physical examination is most likely to reveal which of the following? *(p 170)*

    A. Hepatomegaly
    B. Orchitis
    C. Papilledema
    D. Peripheral edema
    E. Splenomegaly

61. What three signs/symptoms are common to all hepatitis virus infections? *(p 172)* _____

    _____

62. Which serologic markers would most likely be seen in a patient with chronic HBV of low infectivity? Would this be different in the window period, and if so, how? *(p 174)* _____

    _____

63. What tests are used to diagnosis HIV? How are false positives discovered? *(p 175)* _____

_____

_____

64. A 51-year-old man presents to the clinic with a four-month history of increasing cognitive decline characterized by increasing apathy and mental slowing. Physical examination reveals impaired saccadic eye movements, impaired ability to perform rapidly alternating movements, diffuse hyperreflexia, and frontal release signs. CSF analysis shows a total protein level of 72 mg/dL and an elevated IgG level. MRI of the brain shows global cerebral atrophy with multiple ill-defined areas of white matter enhancement. What is the most likely cause? *(p 177)*

    A. CMV encephalitis
    B. CNS lymphoma
    C. Disseminated *Mycobacterium avium–intracellulare* infection
    D. HIV-associated dementia
    E. Toxoplasmosis

65. In a patient with HIV infection, at what CD4 count does prophylaxis against *Pneumocystis jirovecii* become prudent? At what CD4 count does prophylaxis against CMV retinitis become prudent? *(pp 177, 198)* _____

SYSTEMS

66. Why does food poisoning due to *Staphylococcus aureus* or *Bacillus cereus* have such a quick onset? *(p 178)* _____

67. In the following chart, indicate the type of diarrhea caused by each infectious agent. *(p 179)*

Bacterium	Bloody Diarrhea	Watery Diarrhea
Campylobacter		
Clostridium difficile		
Clostridium perfringens		
Entamoeba histolytica		
Enterohemorrhagic *E coli*		
Enteroinvasive *E coli*		
Enterotoxigenic *E coli*		
Salmonella (non-typhoidal)		
Shigella		
Protozoa		
Vibrio cholerae		
Viruses		
Yersinia enterocolitica		

68. A 70-year-old man living in a nursing home presents with neck stiffness, high fever, headache, and photophobia. What is the most likely diagnosis, and what is the most likely causative organism? If the patient were 55 years old, would you suspect a different organism? Why or why not? *(p 180)*

_____

_____

69. A 3-month-old girl is brought to the hospital with a fever. The mother is concerned that she is irritable, will not feed, or stop crying. After ruling out pneumonia and urinary tract infection, meningitis is suspected as the source of the fever. Which three organisms are highest on the differential? How would this list differ in an 18-year old? *(p 180)* _____

_____

_____

70. Fill in the chart below with the typical cerebrospinal fluid findings in meningitis. *(p 180)*

Type of Infection	Opening Pressure	Cell Type	Protein Level	Glucose Level
Bacterial				
Fungal/TB				
Viral				

71. A 10-year-old boy presents with fever, bone pain, and tenderness of the right leg. There is localized redness, swelling and extreme tenderness to palpation of the site. What is the most likely diagnosis, and what is the most likely causative organism? *(p 180)* _____

_____

72. A woman presents to her physician because of pain during urination. She also says that she has to urinate more often than usual and sometimes has trouble "holding it in." What is the most likely diagnosis? What tests would confirm the diagnosis? *(p 181)* _____

_____

73. A woman presents to her physician because of pain during urination. She has also been experiencing fever and chills. She complains that her back has been hurting, and when the physician presses where the patient is pointing, she writhes in pain. What is the most likely diagnosis? What tests would confirm the diagnosis? *(p 181)* _____

_____

_____

_____

74. List the TORCH infections. *(p 182)* _____

_____

_____

75. A child presents to her physician with a rash. His mother says that the rash began on his head and has slowly moved downward, and is now located on his trunk. What two diagnoses should be at the top of the differential? How can these two infections be distinguished? *(p 183)* _____

_____

_____

76. What are the two most common causes of nosocomial infection? *(p 185*) _____

_____

ANTIMICROBIALS

77. Match each antimicrobial with its mechanism of action. (Numbers may be used more than once). *(p 187)*

_____ A. Aminoglycosides
_____ B. Amoxicillin
_____ C. Ampicillin
_____ D. Aztreonam
_____ E. Bacitracin
_____ F. Cephalosporins (I-V)
_____ G. Chloramphenicol
_____ H. Clindamycin
_____ I. Fluoroquinolones
_____ J. Imipenem
_____ K. Linezolid
_____ L. Macrolides
_____ M. Metronidazole
_____ N. Nalidixic acid
_____ O. Penicillin G, V
_____ P. Rifampin
_____ Q. Streptogramins
_____ R. Sulfonamides
_____ S. Tetracyclines
_____ T. Tigecycline
_____ U. Trimethoprim
_____ V. Vancomycin

1. Block DNA gyrase
2. Block folic acid synthesis and reduction
3. Block mRNA synthesis
4. Block peptidoglycan cross-linking
5. Block peptidoglycan synthesis
6. Block protein synthesis at 30S subunit
7. Block protein synthesis at 50S subunit
8. Damage DNA integrity

78. What are the main clinical uses of penicillin? *(p 187)* _____

_____

79. Which antimicrobials are effective against *Pseudomonas*? *(pp 187-190, 195)* _____

_____

80. In the chart below, indicate whether the agents are bacteriostatic or bactericidal. *(pp 187-195)*

Antibiotic	Bactericidal	Bacteriostatic
Aminoglycosides		
Cephalosporins		
Chloramphenicol		
Clindamycin		
Erythromycin		
Fluoroquinolones		
Metronidazole		
Penicillin		
Sulfamethoxazole		
Tetracyclines		
Trimethoprim		
Vancomycin		

81. Match the antimicrobial agent (or class) and its associated adverse effects. *(pp 188, 192-193, 195-197, 199)*

_____ A. Acute cholestatic hepatitis

_____ B. Discoloration of teeth

_____ C. Disulfiram-like reaction

_____ D. “Gray baby” syndrome

_____ E. Gynecomastia

_____ F. Interstitial nephritis

_____ G. Orange body fluids

_____ H. Neurotoxicity

_____ I. Red-green color blindness

_____ J. Systemic lupus erythematosus (SLE)

1. Azoles
2. Chloramphenicol
3. Ethambutol
4. Isoniazid
5. Macrolides
6. Metronidazole
7. Oxacillin
8. Polymyxins
9. Rifampin
10. Tetracyclines

82. Match the generation of cephalosporin with its antimicrobial profile. *(p 189)*

____ A.	First generation (cefazolin, cephalexin)	1.	Serious gram-negative infections
____ B.	Second generation (cefaclor, cefoxitin, cefuroxime, cefotetan)	2.	Gram-+ cocci, *H influenzae*, *Enterobacter aerogenes, Neisseria* spp., *Serratia marcescens, Proteus mirabilis, E coli, Klebsiella pneumoniae*
____ C.	Third generation (ceftriaxone, cefotaxime, cefpodoxime, ceftazidime)	3.	Gram-positive cocci, *Proteus mirabilis*, *E coli*, *Klebsiella pneumoniae*
____ D.	Fourth generation (cefepime)	4.	*Pseudomonas,* gram-positive and gram-negative organisms
____ E.	Fifth generation (ceftaroline)	5.	Broad gram-positive and gram-negative organisms, MRSA, and *Enterococcus faecalis*

83. Which antimicrobial is associated with nephrotoxicity, ototoxicity, and “red man syndrome”? How is this syndrome prevented? *(p 190)* _____

_____

84. True or False: Aminoglycosides are effective against obligate anaerobic infections. *(p 191)*

_____

85. Which antimicrobials are used to treat atypical pneumonias? *(p 193)* _____

86. Which antimicrobials bind to phospholipids on cell membrane of gram-negative bacteria? *(p 193)*

_____

87. Which antimicrobial forms toxic free-radical metabolites in bacterial cells that damage DNA? *(p 195)* _____

88. Fill in the chart below to identify which drugs are used as prophylaxis and as treatment for mycobacterial infections. *(p 196)*

Bacterium	Prophylaxis	Treatment
M avium-intracellulare		
M leprae		
M tuberculosis		

89. Which antifungal agents form membrane pores that allow leakage of electrolytes? To what, specifically, do these antifungals bind? *(p 199)* _____

90. What is the topical form of amphotericin B? What are the three infections it is most commonly used for? *(p 199)* _____

_____

91. What is the mechanism of action of azoles? *(p 199)* _____

_____

92. Match the antiviral drug on the left with its process shown on the right. *(p 201)*

____A.	Acyclovir, etc. (HSV, VZV)	1.	Inhibits nucleic acid synthesis
____B.	Maraviroc	2.	Inhibits protease
____C.	Cidofovir	3.	Inhibits release of progeny virus
____D.	Foscarnet	4.	Inhibits entry of virus
____E.	Ganciclovir (CMV)		
____F.	Atazanavir		
____G.	Oseltamivir		
____H.	Ribavirin (RSV, HCV)		
____I.	Enfuvirtide		
____J.	Zanamivir		
____K.	Lopinavir		

93. What is the mechanism of action of zanamivir and oseltamivir? *(p 201)* _____

_____

94. Match the viral infection with its common treatment. *(pp 201-202, 204)*

_____ A.	Influenza A and B	1.	Acyclovir
_____ B.	Chronic HCV	2.	Ganciclovir
_____ C.	Cytomegalovirus (CMV)	3.	Zanamivir
_____ D.	HSV and VZV	4.	Ribavirin

95. What are the three indications for initiation of antiretroviral therapy (ART)? *(p 203)* _____

_____

96. Why are multiple drugs used in ART? *(p 203)* _____

_____

97. List the three common adverse effects of protease inhibitors. What three adverse effects are specific to indinavir therapy? *(p 203)* _____

_____

98. List the three nonnucleoside reverse transcriptase inhibitors (NNRTIs), the four integrase inhibitors, and the two entry inhibitors. *(p 203)* _____

_____

_____

99. Match the agent with the reason it should be avoided in pregnant women. (One number is used twice.) *(p 204)*

_____ A.	Aminoglycosides	1.	Cartilage damage
_____ B.	Chloramphenicol	2.	Discolored teeth, bone growth inhibition
_____ C.	Clarithromycin	3.	Embryotoxic
_____ D.	Fluoroquinolones	4.	Gray baby syndrome
_____ E.	Griseofulvin	5.	Kernicterus
_____ F.	Ribavirin	6.	Ototoxicity
_____ G.	Sulfonamides	7.	Teratogenic
_____ H.	Tetracyclines		

Answers

BASIC BACTERIOLOGY

1. The capsule.

2. Lipoteichoic acid is found in the cytoplasmic membrane of gram-positive organisms, and endotoxin (LPS/LOS) and embedded proteins (porin and other OMPs) are found in the outer membrane of gram-negative organisms.

3. Mycolic acid.

4. These bacteria do not Gram stain well: *Treponema*, *Leptospira*, Mycobacteria, *Mycoplasma, Ureaplasma, Legionella, Rickettsia, Chlamydia, Bartonella, Anaplasma,* and *Ehrlichia.* The following alternate stains are used on a subset of these bacteria:

   Giemsa stain: *Chlamydia* and *Rickettsia*.

   Ziehl-Neelsen stain (carbol fuchsin): *Mycobacteria*.

   Silver stain: *Legionella.*

   Dark-field microscopy/direct fluorescent antibody (DFA) microscopy: *Treponema*.

5. E. The Ziehl-Neelsen stain is used to detect acid-fast bacteria. This patient most likely has tuberculosis, which is an acid-fast aerobic bacillus.

6. Fungi require a silver stain and are cultured on Sabouraud agar.

7. Thayer-Martin agar.

8. *Streptococcus pneumoniae, Haemophilus influenzae type b,* and *Neisseria meningitidis.*

9. M protein.

10. Specialized transduction.

11. Transformation.

12. Conjugation.

13. Most exotoxins are heat-**labile**, have **high** toxicity, and **can** be vaccinated against. In contrast, endotoxins are heat-**stable**, have **low** toxicity, and **cannot** be vaccinated against.

14. Lipid A component of Lipopolysaccharides (LPS); TNF; IL-1; IL-6.

15. *Vibrio cholerae*, *Bordetella pertussis*, *Enterotoxigenic Escherichia (E) coli* (heat-labile toxin), and *Bacillus anthracis.*

CLINICAL BACTERIOLOGY

16. *Staphylococcus aureus.*

17. MRSA have developed an altered penicillin-binding protein that makes them resistant to antibiotics.

18. E. *Streptococcus pneumoniae* is the most common cause of community acquired pneumonia.

19. E. Rheumatic fever. This patient initially had *Streptococcus pyogenes* pharyngitis which was not adequately treated with antibiotics and therefore placed the patient at risk for rheumatic fever, which manifested as polyarthritis in this case.

20. a) A. Ampicillin. *Clostridioides difficile* produces toxins A and B which damage enterocytes, which lead to pseudomembranous colitis. It also releases a toxin that causes watery diarrhea. Classically, ampicillin and clindamycin lead to *C difficile* overgrowth and pseudomembranous colitis, but almost any antibiotic can cause this disease. This particular patient had an enterococcal infection, which is treated with ampicillin.

    b) D. Metronidazole.

    c) Vancomycin or fidaxomicin.

21. *Actinomyces* is an **anaerobe** that causes **oral/facial abscesses**, whereas *Nocardia* is an **aerobe** that causes **pulmonary infection in immunocompromised patients**. Both have a **branching filament structure**.

22. Current infection or past exposure.

23. a) B. Gram-negative diplococci. These patients likely have bacterial meningitis. Bacterial meningitis is characterized by increased polymorphonuclear leukocytes, increased protein, and decreased glucose in the CSF. The most likely cause in this setting (young adults) is *Neisseria meningitidis*, which is a gram-negative diplococcus that ferments maltose and glucose. (*N gonorrhoeae* ferments only glucose.)

    b) C. Rifampin.

24. *Acinetobacter baumannii.*

25. A. *Bordetella pertussis*. This is a typical presentation of pertussis, or whooping cough. The patient has not been immunized and has characteristic coughing paroxysms interspersed with a loud "whooping" sound caused by inspiration against a narrowed airway. This paroxysmal phase is preceded by the catarrhal phase that is indistinguishable from common upper respiratory infections. Post-tussive emesis (vomiting after a coughing spell) also is common with pertussis. A prominent lymphocytosis is often present as well. This is presumably caused by the ability of pertussis toxin to inhibit chemokine receptors. A culture of *Bordetella pertussis* takes 7-10 days; therefore, it is important to make a presumptive diagnosis based on the clinical picture.

26. B. *Legionella pneumophila* is a gram-negative rod that causes Legionnaires' disease, a condition in which pneumonia and fever occur. Other signs include GI and CNS changes. The organism is present only in water sources (eg, air conditioning systems, hot water tanks, mist sprayers) and can cause infection when aerosolized water droplets are inhaled. The organism is not transmitted by person-to-person contact.

27. *Brucella* is the likely cause. It is transmitted by ingesting contaminated animal products such as unpasteurized milk. Treatment is doxycycline + rifampin or streptomycin.

28. *Shigella*. Enterohemorrhagic *E coli* (EHEC).

29. Fimbriae–cystitis and pyelonephritis; K capsule–pneumonia, neonatal meningitis; and LPS endotoxin–septic shock.

30. A. *Campylobacter jejuni.* This patient has Guillain-Barré syndrome, an acute peripheral neuropathy that causes progressive weakness over several days. Approximately two-thirds of these patients have an antecedent gastrointestinal or flulike illness. The most common involves *Campylobacter jejuni* infections.

31. Primary syphilis is localized and presents with a painless chancre. Secondary syphilis is disseminated and causes constitutional symptoms, maculopapular rash, condylomata lata, lymphadenopathy, patchy hair loss. Tertiary syphilis is associated with gummas, neurosyphilis (tabes dorsalis, “general paresis”), and Argyll Robertson pupil, also called “prostitute’s pupil.”

32. Pupils that constrict with accommodation but do not react to light. This is can be seen in tertiary syphilis.

33. A flu-like syndrome caused by killed bacteria releasing toxins following antibiotic treatment. Symptoms include fever, chills headache, and myalgia.

34. Classically described as “clue cells” which are vaginal epithelial cells coated with *Gardnerella* bacteria; they have stippled appearance along the outer margin.

35. Anaplasmosis (*Anaplasma* spp), Lyme disease (*Borrelia burgdorferi*), Ehrlichiosis (*Ehrlichia chaffeensis*), Tularemia (*Francisella tularensis*), and Rocky Mountain spotted fever (*Rickettsia rickettsii*).

36. The rash of RMSF starts on the wrists and ankles and then spreads to the trunk, palms, and soles; the rash of typhus starts on the trunk (centrally) and spreads outward but spares the palms and soles.

MYCOLOGY

37. A-1, B-4, C-2, D-3.

38. Tinea (pityriasis) versicolor (caused by *Malassezia* spp).

39. Oral and esophageal thrush in immunocompromised, vulvovaginitis, diaper rash, endocarditis, disseminated candidiasis, and chronic mucocutaneous candidiasis.

40. *Mucor and Rhizopus spp.*, which is treated with surgical debridement and amphotericin B or isavuconazole.

41. *Pneumocystis jirovecii.*

PARASITOLOGY

42. *Giardia lamblia, Entamoeba histolytica*, and *Cryptosporidium* are likely to cause GI infections, whereas *Trypanosoma cruzi* and *Leishmania* spp are likely to cause visceral infections. Fatty diarrhea: *Giardia lamblia*. Bloody: *Entamoeba histolytica*. Watery: *Cryptosporidium*.

43. A-3, B-1, C-2, D-5, E-3, F-4.

44. *P ovale* and *P vivax.* Because they have the ability to lie dormant in the liver.

45. *Trypanosoma cruzi*, which causes Chagas disease–dilated cardiomyopathy with apical atrophy, megacolon, megaesophagus.

46. a) *Trichomonas vaginalis* infection.

    b) Metronidazole for patient and partner. Tell the patient not to consume alcohol while on the medication as this can cause a disulfiram-like reaction.

47. *Enterobius vermicularis* (pinworm)*, Ascaris lumbricoides* (giant roundworm)*, Trichinella spiralis, Toxocara canis, and Trichuris trichiura* (whipworm)*.*

48. *Strongyloides stercoralis* (threadworm), *Ancylostoma* spp*,* and *Necator americanus* (hookworms).

49. Bendazoles are typically used to kill intestinal nematodes, whereas Praziquantel is typically used to kill flukes.

50. A-1, B-4, C-2, D-3, E-4, F-4.

51. D. *Taenia solium.* Although this patient's presentation is highly suggestive of malignancy, the image confirms neurocysticercosis, which is caused by infection with *Taenia solium*, a pork tapeworm.

52. *Schistosoma haematobium.*

VIROLOGY

53. Nucleus; cytoplasm.

54. a) B. Erythema of cheeks. Parvovirus B19 is associated with red cheeks or a "slapped cheek" appearance.

    b) If a pregnant woman contracts parvovirus, it can be transmitted to the fetus and lead to hydrops fetalis and death.

    c) Pure RBC aplasia and rheumatoid arthritis-like symptoms.

55. C. JC virus. The clinical picture and imaging are consistent with progressive multifocal leukoencephalopathy (PML) secondary to reactivation of latent JC virus infection, which can occur with CD4 counts <50/mm^3. It typically presents with rapidly progressive focal neurologic deficits without signs of increased intracranial pressure. Ataxia, aphasia, and cranial nerve deficits also may occur. Lumbar puncture is nondiagnostic and frequently shows mild elevations in protein and WBCs. CSF analysis can show myelin basic protein, which is due to demyelination caused by the JC virus. PML is characterized by multiple nonenhancing T_2-hyperintense lesions on MRI. When PML is suspected, a stereotactic biopsy is required for definitive diagnosis; however, a positive CSF polymerase chain reaction for JC virus is diagnostic in the appropriate clinical setting.

56. Cells infected with Cytomegalovirus (HHV-5) demonstrate characteristic “owl eye” inclusion bodies.

57. B. Respiratory muscle paralysis. This child has classic symptoms of polio. Poliovirus infects Peyer patches of the intestine and the motor neurons. It is passed by the fecal-oral route and can present as a spectrum of severity, depending on the patient’s age. Younger children and infants often have a nonclinical infection or mild fever with diarrhea. In older children who have not previously been infected, meningitic signs can develop. The most severe complications are respiratory muscle failure, paraplegia, and quadriplegia.

58. Rotavirus. This virus has **double-stranded**, **segmented RNA**.

59. a) E. Measles (rubeola) is relatively uncommon in the United States due to the MMR vaccine, but becoming more common due to some individuals choosing not to vaccinate their children. The rash that spreads from head to toe develops 1-2 days after the appearance of red oral lesions with blue-white centers.

    b) Koplik spots.

60. B. Orchitis. Mumps is an infectious disease that can cause swollen cheeks. Although not often seen in the United States because of the MMR vaccine, mumps occasionally presents in those who have not been vaccinated. Mumps is caused by an RNA paramyxovirus that replicates in the upper respiratory tract and causes parotitis and, frequently, orchitis. Pancreatitis and meningitis can also be present.

61. Episodic fevers, jaundice, and elevated ALT and AST levels.

62. HBsAg antigen, anti-HBe and anti-HBc antibodies. During the window period, you will see anti-HBc and anti-HBe antibodies, which indicate low transmissibility as the body is resolving the infection.

63. A presumptive diagnosis is made with HIV-1/2 Ag/Ab immunoassays, which are highly sensitive and detect viral p24 Ag capsid protein and IgG Abs to HIV-1/2. Viral load tests determine the amount of viral RNA in the plasma. High viral load is associated with poor prognosis. Also use viral load to monitor effect of drug therapy. Use HIV genotyping to determine appropriate therapy.

64. D. HIV-associated dementia (also known as AIDS dementia) presents with memory loss, gait disorder, and spasticity. It generally occurs later in the course of illness. Early symptoms may be subtle and include depressive symptoms and apathetic withdrawal; later symptoms include global dementia and motor deficits. As the dementia progresses, patients experience difficulty with smooth limb movement, dysdiadochokinesia (impairment in performing rapid, alternating movements), impaired saccadic eye movements, hyperreflexia, and frontal release signs. Imaging studies are imperative to rule out mass lesions; 20-40% of patients demonstrate nonenhancing, poorly demarcated areas of increased T_2 signal intensity in the deep white matter. The symptoms must be distinguished from typical focal neurologic signs and symptoms that may be evident in patients with mass lesions. Elevated levels of protein and IgG on CSF analysis are present in approximately 45% and 80% of cases, respectively.

65. A CD4 count <200 mm^3; a CD4 count <100 mm^3.

SYSTEMS

66. Because the toxin is preformed when ingested.

67.

Bacterium	Bloody diarrhea	Watery diarrhea
Campylobacter	√	
Clostridium difficile	√	√
Clostridium perfringens		√
Entamoeba histolytica	√	
Enterohemorrhagic *E coli*	√	
Enteroinvasive *E coli*	√	
Enterotoxigenic *E coli*		√
Salmonella (non-typhoidal)	√	
Shigella	√	
Protozoa		√
Vibrio cholerae		√
Viruses		√
Yersinia enterocolitica	√	

68. The patient likely has meningitis caused by *Streptococcus pneumoniae.* If the patient were younger, it would be more likely to be caused by *Neisseria meningitidis.*

69. Group B *Streptococcus*, *E coli*, and *Listeria.* For an 18-year-old: *Streptococcus pneumoniae, Neisseria meningitidis,* enteroviruses, or HSV. *Neisseria meningitidis* is the most common in high-school-aged people.

70.

Type of Infection	Opening Pressure	Cell Type	Protein Level	Glucose Level
Bacterial	↑	↑ PMNs	↑	↓
Fungal/TB	↑	↑ Lymphocytes	↑	↓
Viral	Normal/↑	↑ Lymphocytes	Normal/↑	Normal

71. Osteomyelitis; *Staphylococcus aureus.*

72. This patient has a UTI. Urinalysis will show a high WBC count in the urine, positive leukocyte esterase, and nitrites. The most likely organism is *E coli*.

73. This patient has pyelonephritis. Know the symptoms that differentiate a lower UTI from an infection that has ascended into the kidneys. Patients with pyelonephritis demonstrate systemic signs of infection including fever and chills and will also have costovertebral angle tenderness on physical exam, which are both seen in this patient. On urinalysis, pyelonephritis is characterized by WBC casts in addition to WBCs, nitrites, and leukocyte esterase. The most likely cause is *E coli.*

74. The TORCH infections are ***To****xoplasma gondii*, **R**ubella, **C**ytomegalovirus, **H**IV, **He**rpes simplex virus-2, and **S**yphilis.

75. Measles (rubeola) and rubella. Both present with similar symptoms such as rash on the face and fever. Distinguishing feature for measles: look for the **4 C**'s: **c**ough, **c**oryza, **c**onjunctivitis, and "**C**"oplik spots. For rubella: look for postauricular lymphadenopathy.

76. *E coli* (UTI) and *S aureus* (wound infection).

ANTIMICROBIALS

77. A-6, B-4, C-4, D-4, E-5, F-4, G-7, H-7, I-1, J-4, K-7, L-7, M-8, N-1, O-4, P-3, Q-7, R-2, S-6, T-6, U-2, V-5.

78. Mostly used for gram-positive organisms *(S pneumoniae, S pyogenes, Actinomyces).* Also used for gram negative cocci *(mainly N meningitidis) and spirochetes (mainly T pallidum).*

79. Ticarcillin, piperacillin, third- and fourth-generation cephalosporins, and fluoroquinolones; ertapenem (a newer carbapenem) has limited coverage against *Pseudomonas*.

80.

Antibiotic	Bactericidal	Bacteriostatic
Aminoglycosides	√	
Cephalosporins	√	
Chloramphenicol		√
Clindamycin		√
Erythromycin		√
Fluoroquinolones	√	
Metronidazole	√	
Penicillin	√	
Sulfamethoxazole		√
Tetracyclines		√
Trimethoprim		√
Vancomycin	√	√ (vs *C difficile*)

81. A-5, B-10, C-6, D-2, E-1, F-7, G-9, H-8, I-3, J-4.

82. A-3, B-2, C-1, D-4, E-5.

83. Vancomycin; preventable by pretreatment with antihistamines.

84. False; aminoglycosides cannot kill anaerobes.

85. Macrolides.

86. Polymyxins.

87. Metronidazole.

88.

Bacterium	Prophylaxis	Treatment
M avium-intracellulare	Azithromycin, Rifabutin	Azithromycin or clarithromycin + ethambutol. Can add rifabutin or ciprofloxacin.
M leprae	None	Dapsone and rifampin for tuberculoid form. Add clofazimine for lepromatous form.
M tuberculosis	Isoniazid	**R**ifampin, **I**soniazid, **P**yrazinamide, **E**thambutol (**RIPE** for treatment)

89. Amphotericin B binds to ergosterol.

90. Nystatin. Used in the treatment of oral candidiasis, diaper rash, and vaginal candidiasis.

91. Inhibit fungal sterol (ergosterol) synthesis by inhibiting the cytochrome P-450 enzyme that converts lanosterol to ergosterol.

92. A-1, B-4, C-1, D-1, E-1, F-2, G-3, H-1, I-4, J-3, K-2.

93. Influenza neuraminidase inhibition.

94. A-3, B-4, C-2, D-1.

95. AIDS-defining illness, low CD4+ cell counts (< 500/cells mm^3), or a high viral load.

96. To prevent the development of resistance against therapy.

97. Hyperglycemia, GI intolerance (nausea, diarrhea), and lipodystrophy (Cushing-like syndrome). Nephropathy, hematuria and thrombocytopenia are specific to indinavir therapy.

98. NNRTIs: delavirdine, efavirenz, nevirapine. Integrase inhibitors: bictegravir, raltegravir, elvitegravir, dolutegravir. Entry inhibitors: enfuvirtide, maraviroc.

99. A-6, B-4, C-3, D-1, E-7, F-7, G-5, H-2.

Immunology

Questions

LYMPHOID STRUCTURES

1. Which lymph node structures communicate with efferent lymphatics and contain reticular cells and macrophages? *(p 96)* _____

2. Which lymph node area contains endothelial venules through which T and B cells enter the nodes from the blood? *(p 96)* _____

3. Which part of the lymph node contains B cells? *(p 96)* _____

4. In which part of the lymph node are follicles located? *(p 96)* _____

5. Which lymph node area enlarges during an extreme cellular immune response? *(p 96)*

   _____

6. Match the area of the body with its primary lymph node drainage site. (Numbers may be used more than once). *(p 97)*

_____ A.	Anal canal (below pectinate line), skin below umbilicus (except popliteal area), scrotum, and vulva	1. Axillary lymph nodes 2. Celiac lymph nodes 3. Cervical lymph nodes 4. Hilar lymph nodes 5. Inferior mesenteric lymph nodes 6. Internal iliac lymph nodes 7. Mediastinal lymph nodes 8. Para-aortic lymph nodes 9. Popliteal lymph nodes 10. Superficial inguinal lymph nodes 11. Superior mesenteric lymph nodes
_____ B.	Colon from splenic flexure to upper rectum	
_____ C.	Dorsolateral foot and posterior calf	
_____ D.	Head and neck	
_____ E.	Liver, stomach, spleen, pancreas, and upper duodenum	
_____ F.	Lower duodenum, jejunum, ileum, and colon to splenic flexure	
_____ G.	Lower rectum to anal canal (above pectinate line), bladder, vagina (middle third), cervix, and prostate	
_____ H.	Lungs	
_____ I.	Testes, ovaries, kidneys, and uterus	
_____ J.	Trachea and esophagus	
_____ K.	Upper limbs, breast, and skin above umbilicus	

7. Which side of the upper body does the thoracic duct drain? *(p 97)* _____

8. What are the distinct blood findings seen on peripheral blood smears of postsplenectomy patients? *(p 98)* _____

_____

9. Postsplenectomy patients are most susceptible to which pathogens? *(pp 98, 118)*

_____

_____

10. B cells mature in the _____ (bone marrow/thymus), whereas T cells mature in the _____ (bone marrow/thymus). *(p 98)*

CELLULAR COMPONENTS

11. In the following chart, indicate which components are part of the adaptive versus the innate immune system. *(p 99)*

Component	Adaptive Immune System	Innate Immune System
Antibody		
B cells		
Complement		
Dendritic cells		
Macrophages		
Monocytes		
Natural killer (NK) cells		
Neutrophils		
Physical epithelial barriers		
Secreted enzymes		
T cells		

12. What are the three MHC class I genetic loci? *(p 100)* _____

13. What are the three MHC class II genetic loci? *(p 100)* _____

14. What cell surface markers are specific to natural killer cells? *(p 101, 110)* _____

15. Which cytokine is secreted by Th1 cells, enhancing the ability of monocytes and macrophages to kill microbes they ingest? *(p 102)* _____

16. Name the enzymes used by CD8 in cytotoxic T cells to kill virus-infected, neoplastic, and donor graft cells. *(p 102)* _____

17. What two major anti-inflammatory cytokines are produced by regulatory T cells? *(p 102)* _____

IMMUNE RESPONSES

18. By which three mechanisms is antibody diversity generated? *(p 104)* _____

_____

_____

19. Match each immunoglobulin isotype with its characteristic. (Numbers may be used more than once.) *(p 105)*

_____ A.	Activates eosinophils	1.	IgA
_____ B.	Antigen receptor on B cell surface	2.	IgD
_____ C.	Binds mast cells and basophils	3.	IgG
_____ D.	Fixes complement and crosses the placenta	4.	IgE
_____ E.	Fixes complement	5.	IgM
_____ F.	Function unclear; found on B cells and in serum		
_____ G.	Produced in in 1° response to an antigen		
_____ H.	Main antibody in 2° response to an antigen		
_____ I.	Mediates immediate (type I) hypersensitivity		
_____ J.	Neutralizes bacterial toxins and viruses		
_____ K.	Opsonizes bacteria		
_____ L.	Prevents attachment of bacteria and viruses to mucous membranes		

20. What activates the alternative, lectin, and classic pathways? *(p 106)* _____

_____

_____

21. Which cytokines are secreted by macrophages? *(p 108)* _____

22. Which cytokines are secreted by T cells? *(p 108)* _____

23. Match the cytokine with its action(s). *(p 108)*

_____ A. Activates endothelium

_____ B. Attenuates inflammatory response, decreases expression of MHC class II and Th1 cytokines, and inhibits activated macrophages and dendritic cells

_____ C. Causes fever and acute inflammation, induces chemokine secretion, and activates endothelium to express adhesion molecules

_____ D. Causes fever and stimulates production of acute-phase proteins

_____ E. Induces differentiation of T cells to Th1 cells, activates NK cells

_____ F. Induces differentiation of T cells to Th (helper) 2 cells, promotes growth of B cells, and enhances class switching to IgE and IgG

_____ G. Inhibits differentiation of Th2 cells, stimulates macrophages to kill phagocytosed pathogens, activates NK cells to kill virus-infected cells, and increases MHC expression and antigen presentation by all cells

_____ H. Major chemotactic factor for neutrophils

_____ I. Promotes growth and differentiation of B cells and eosinophils, enhances class switching to IgA

_____ J. Stimulates growth of helper, cytotoxic, and regulatory T cells and NK cells

_____ K. Supports growth and differentiation of bone marrow stem cells

1. IL-1
2. IL-2
3. IL-3
4. IL-4
5. IL-5
6. IL-6
7. IL-8
8. IL-10
9. IL-12
10. INF-γ
11. TNF-α

24. In the chart below, check the cell surface proteins and receptors that are expressed by each type of cell. *(p 110)*

Protein/Receptor	B cells	T cells	Macrophages	NK cells
B7				
C3b receptor				
CD3				
CD4				
CD8				
CD14				
CD19				
CD20				
CD21				
CD28				
CD40				
CD40L				
CD56				
Fc receptor				
Ig				
MHC I				
MHC II				
TCR				

25. Which type of vaccination induces strong, often life-long immunity? *(p 111)* _____

26. Which type of hypersensitivity reaction utilizes opsonization? *(p 112)* _____

27. Which type of hypersensitivity reaction occurs rapidly due to preformed antibody? *(p 112)* _____

28. Which type of hypersensitivity reaction is mediated by accumulation of immune complexes? *(p 113)*

_____

29. Which type of hypersensitivity reaction involves direct cytotoxicity? *(p 113)* _____

30. Match the autoantibody with its associated disorder. *(p 115)*

_____ A. Anti-postsynaptic ACh receptor	1. Antiphospholipid syndrome
_____ B. Anti-β_2 glycoprotein I	2. Autoimmune hepatitis type 1
_____ C. Anticardiolipin, lupus anticoagulant	3. Bullous pemphigoid
_____ D. Anticentromere	4. Celiac disease
_____ E. Anti-desmoglein (anti-desmosome)	5. Limited scleroderma (CREST syndrome)
_____ F. Anti-dsDNA, anti-Smith	6. Type I diabetes mellitus
_____ G. Anti-glomerular basement membrane	7. Drug-induced lupus
_____ H. Anti-glutamic acid decarboxylase islet cell cytoplasmic antibodies	8. Goodpasture syndrome 9. Graves disease
_____ I. Anti-hemidesmosome	10. Granulomatosis with polyangiitis (Wegener)
_____ J. Antihistone	
_____ K. Antithyroglobulin, antithyroid peroxidase (antimicrosomal)	11. Hashimoto thyroiditis 12. Lambert-Eaton myasthenic syndrome
_____ L. Antimitochondrial	
_____ M. Antiparietal cell, anti-intrinsic factor	13. Microscopic polyangiitis, eosinophilic granulomatosis with polyangiitis (Churg-Strauss syndrome), ulcerative colitis
_____ N. Anti-phospholipase A_2 receptor	
_____ O. Anti-presynaptic voltage-gated calcium channel	
_____ P. Anti-Scl-70 (anti-DNA topoisomerase I)	14. Mixed connective tissue disease
_____ Q. Anti-smooth muscle	15. Myasthenia gravis
_____ R. Anti-Ro/SSA, anti-La/SSB	16. Pemphigus vulgaris
_____ S. Antisynthetase (eg, anti-Jo-1), anti-SRP, and anti-helicase (anti-Mi-2)	17. Pernicious anemia 18. Primary biliary cholangitis
_____ T. Anti-TSH receptor	19. Primary membranous nephropathy
_____ U. Anti-U1 RNP (ribonucleoprotein)	20. Polymyositis and dermatomyositis
_____ V. IgA anti-endomysial, IgA anti-tissue transglutaminase, IgA and IgG deamidated gliadin peptide	21. Rheumatoid arthritis 22. Scleroderma (diffuse)
_____ W. MPO-ANCA/p-ANCA	23. Sjögren syndrome
_____ X. PR3-ANCA/c-ANCA	24. SLE
_____ Y. Rheumatoid factor (IgM antibody against IgG Fc region), anti-CCP	25. SLE and antiphospholipid syndrome

31. What immunodeficiency is most closely associated with each clinical scenario? *(pp 116-117)*

    A. An 18-month-old boy presents with a 12-month history of recurrent sinusitis and otitis media infections. _____

    B. An infant is brought to his pediatrician for the sixth time in several months. Oral thrush and upper respiratory infection have been diagnosed previously, and he underwent incision and drainage of several buttock abscesses. Chest X-ray demonstrates an absence of thymic shadow. _____

    C. An infant arrives for her 2-month well-child visit. Her abdomen is soft and nontender, but her umbilical remnant is still present. A red, firm area is present on the back of her thigh, with no evidence of fluctuance. _____

    D. A 5-year-old girl presents with recurrent skin infections. In the past, she has been treated for an *E coli* urinary tract infection as well as numerous *Candida* infections. A dihydrorhodamine test is performed and there is decreased green fluorescence. _____

    E. A 9-year-old boy presents with coarse facies and recurrent skin infections. Physical examination reveals he has two sets of teeth where his adult dentitia have erupted. _____

    _____

32. Which autosomal-recessive immune deficiency presents with recurrent pyogenic infections, partial albinism, and peripheral neuropathy? *(p 117)* _____

33. Which immunodeficiency presents with a triad of symptoms that include recurrent pyogenic infections, thrombocytopenia, and eczema? *(p 117)* _____

34. Name two possible causes of severe combined immunodeficiency. *(p 117)* _____

    _____

35. What are the signs and symptoms of graft-versus-host disease? *(p 119)* _____

    _____

IMMUNOSUPPRESSANTS

36. What is the mechanism of action of cyclosporine, and to which organ is it most toxic? *(p 120)* ____

    _____

37. What is the mechanism of action of sirolimus, and what effect does this have on immunity? *(p 120)*

_____

_____

38. Name the agents that can stimulate the production of RBCs, WBCs, and platelets respectively.

(p 121) _____

39. Which antibodies are used to treat the following diseases? *(p 122)*

a) Inflammatory bowel disease _____

b) Osteoporosis_____

c) Refractory allergic asthma _____

Answers

LYMPHOID STRUCTURES

1. Medullary sinuses.
2. Paracortex.
3. Follicles.
4. Outer cortex.
5. Paracortex.
6. A-10, B-5, C-9, D-3, E-2, F-11, G-6, H-4, I-8, J-7, K-1.
7. Left.
8. Howell-Jolly bodies, target cells, thrombocytosis, and lymphocytosis.
9. Encapsulated bacteria such as ***P****seudomonas aeruginosa,* ***S****treptococcus pneumoniae,* ***H****aemophilus influenzae* type b, ***N****eisseria meningitidis,* ***E****scherichia coli,* ***S****almonella*, ***K****lebsiella pneumoniae,* and Group B **S**treptococcus (**P**lease **SHINE** my **SK**i**S**).
10. Bone marrow; thymus.

CELLULAR COMPONENTS

11.

Component	Adaptive Immune System	Innate Immune System
Antibody	√	
B cells	√	
Complement		√
Dendritic cells		√
Macrophages		√
Monocytes		√
Natural killer (NK) cells		√
Neutrophils		√
Physical epithelial barriers		√
Secreted enzymes		√
T cells	√	

12. HLA-A, HLA-B, HLA-C.

13. HLA-DR, HLA-DP, HLA-DQ.

14. CD56 and CD16.

15. Interferon gamma (IFN-γ).

16. Perforin and granzyme B.

17. IL-10 and TGF-β.

IMMUNE RESPONSES

18. Random recombination of VJ (light-chain) or V(D)J (heavy-chain) genes, random combination of heavy and light chains, and random addition of nucleotides to DNA during genetic recombination by terminal deoxynucleotidyl transferase (TdT).

19. A-4, B-5, C-4, D-3, E-5, F-2, G-5, H-3, I-4, J-3, K-3, L-1.

20. The Alternative pathway is activated by microbe surface molecules. The Lectin pathway is activated by mannose or other sugars on microbial surfaces, and the Classic pathway is activated by antigen-antibody complexes (IgG and IgM).

21. IL-1, IL-6, IL-8, IL-12, and TNF-α.

22. IL-2, IL-3, interferon-γ, IL-4, IL-5, and IL-10.

23. A-11, B-8, C-1, D-6, E-9, F-4, G-10, H-7, I-5, J-2, K-3.

24.

Protein/Receptor	B cells	T cells	Macrophages	NK cells
B7	√		√	
C3b receptor			√	
CD3		√		
CD4		√		
CD8		√		
CD14			√	
CD19	√			
CD20	√			
CD21	√			
CD28		√		
CD40	√		√	
CD40L		√		
CD56				√
Fc receptor			√	
Ig	√			
MHC I	All nucleated cells except RBCs	All nucleated cells except RBCs	All nucleated cells except RBCs	All nucleated cells except RBCs
MHC II	√		√	
TCR		√		

25. Live attenuated vaccine.

26. Type II.

27. Type I.

28. Type III.

29. Type IV.

30. A-15, B-1, C-25, D-5, E-16, F-24, G-8, H-6, I-3, J-7, K-11, L-18, M-17, N-19, O-12, P-22, Q-2, R-23, S-20, T-9, U-14, V-4, W-13, X-10, Y-21.

31. A. X-linked (Bruton) agammaglobulinemia; B. Severe combined immunodeficiency;

    C. Leukocyte adhesion deficiency (type 1); D. Chronic granulomatous disease;

    E. Autosomal dominant hyper-IgE syndrome (Job syndrome).

32. Chédiak-Higashi syndrome.

33. Wiskott-Aldrich syndrome.

34. Defective IL-2R gamma chain and adenosine deaminase deficiency.

35. Maculopapular rash, jaundice, hepatosplenomegaly, and diarrhea.

IMMUNOSUPPRESSANTS

36. Inhibits calcineurin and blocks T-cell activation by preventing IL-2 transcription. It is most toxic to the kidney.

37. Inhibits mammalian target of rapamycin (mTOR), binds FKBP, and blocks T-cell activation and B-cell differentiation by preventing response to IL-2.

38. Epoetin alfa (EPO analog) → stimulates erythropoietin (RBC production)

    Filgrastim/Sargramostim → stimulates colony stimulating factor (WBC production)

    Romiplostim/Eltrombopag → stimulates thrombopoietin (platelet production)

39. a) Adalimumab, infliximab, and natalizumab.

    b) Denosumab.

    c) Omalizumab

Musculoskeletal, Skin, and Connective Tissue

Questions

ANATOMY AND PHYSIOLOGY

1. In the chart below, describe the characteristics of brachial plexus lesions. *(pp 447-448, 450-451)*

Lesion	Injured Nerve(s)	Presentation	Affected Muscle(s)
Ape hand			
Erb palsy			
Klumpke palsy			
Median claw			
Ulnar claw			

2. A 36-year-old man presents with difficulty abducting his left arm above 15 degrees. His left shoulder appears flattened and asymmetric to his right arm. What sensory deficit is most likely? Which nerve is likely involved? *(p 447)* _____

_____

3. A 24-year-old woman was in a car accident and suffered a fracture of the midshaft of her humerus. When asked to hold up her arm, her wrist could not be extended. What sensory deficits is she likely experiencing? Which nerve is most likely affected? *(p 447)* _____

_____

4. A 20-year-old man presents with a fracture of his medial epicondyle. When asked to flex his wrist, his hand is radially deviated. Why is this deviation happening? *(p 447)* _____

_____

5. A 42-year-old man presents to the clinic with difficulty adducting his thigh. He had been skiing the previous week. He mentions that his thigh is hurting and that he's not sure what he did to it. What type of injury is most likely? *(p 452)* _____

_____

6. A 22-year-old man is brought to the emergency department after a motor vehicle accident. His blood alcohol level is 0.20. He was not wearing a seatbelt. Physical examination reveals he has substantial difficulty extending his leg. What injury is most likely? *(p 452)* _____

_____

7. A 30-year-old man comes to the physician after being tackled below the knee in a football game with his friends. The patient is using a steppage gait. What is the most likely diagnosis, and what sensory deficits are likely? *(p 453)* _____

_____

8. A 22-year-old woman has difficulty climbing stairs. What type of mechanical injury would pre-dispose her to this problem? *(p 453)* _____

_____

9. A 23-year-old woman who was a passenger in a motor vehicle accident is brought to the emergency department. She was wearing a seat belt. Physical examination reveals trauma to the lateral aspect of the knee. What motor deficit is most likely? *(p 453)* _____

_____

10. In a case of possible knee injury, abnormal passive abduction indicates a torn _____ (ACL/MCL), and an anterior drawer sign indicates a torn _____ (ACL/MCL) *(p 454)*

11. An injury to which ligament represents the most common type of ankle sprain? *(p 455)* _____

_____

12. What artery is paired with the long thoracic nerve? *(p 455)* _____

13. What nerve and artery are located in the popliteal fossa? *(p 455)* _____

14. _____ (Type I/Type II) muscle is associated with increased oxidative phosphorylation, whereas _____ (type I/type II) muscle is associated with increased anaerobic glycolysis. *(p 457)*

15. _____ (Muscle spindles/Golgi tendon organ) facilitate(s) inhibition of antagonist muscle to prevent overstretching and activation of agonist muscle (contraction). _____ (Muscle spindles/Golgi tendon organ) facilitate(s) inhibition of agonist muscle to reduce tension within the muscle and tendon. *(p 458)*

16. How do osteoblasts build bone? How do osteoclasts dissolve bone? *(p 459)* _____

_____

17. What are the effects of PTH on bone? *(p 459)* _____

_____

PATHOLOGY

18. Which fracture, most commonly seen the in 4th and 5th metacarpals, is also called boxer's fracture? *(p 459)* _____

19. Which hand injury can cause paresthesia, pain, or numbness due to a compressed nerve? Which wrist injury is common among cyclists due to pressure from handlebars? *(p 459)* _____

_____

20. Which fracture is usually caused by a fall on an outstretched hand or by direct trauma to the shoulder? Where is the bone most likely to be fractured? *(p 460)* _____

_____

21. What ligaments are torn in the unhappy triad? *(p 460)* _____

22. What causes medial tibial stress syndrome (shin splints)? *(p 461)* _____

_____

23. How is developmental dysplasia of the hip diagnosed in newborns? *(p 461)* _____

_____

_____

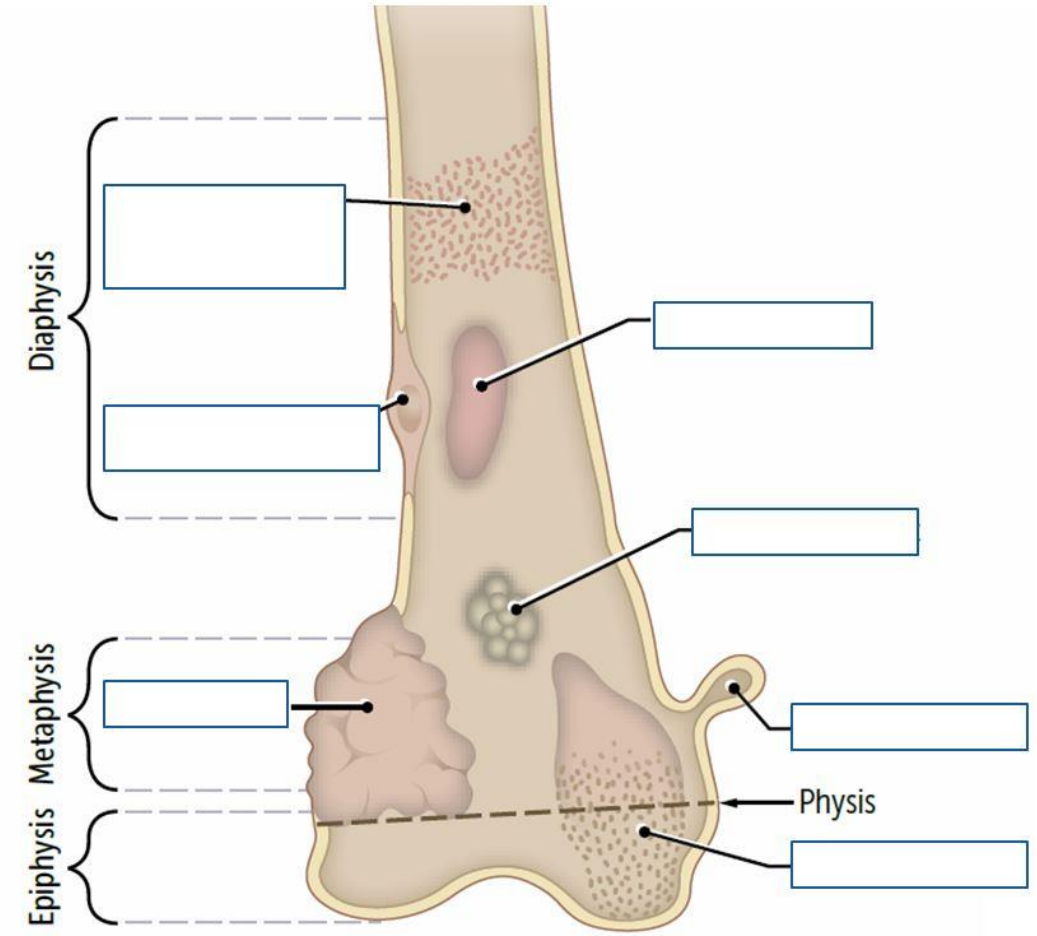
24. Indicate whether the lab findings for each condition in the chart below are elevated, decreased, or normal. *(p 464)*

Condition	ALP	PO_4^{3-}	PTH	Serum Ca^{2+}
Osteitis fibrosa cystica, primary hyperparathyroidism				
Osteitis fibrosa cystica, secondary hyperparathyroidism				
Osteomalacia/rickets				
Osteopetrosis				
Osteoporosis				
Paget disease of bone				

25. What disease is associated with increased risk of osteosarcoma? *(p 465)* _____

_____

26. In the image below, identify the type of tumor according to its location in the bone. *(p 465)*



27. A 64-year-old man with no significant medical history has had increasing back pain and right hip pain for the past decade. The pain is worse at the end of the day. Physical examination shows enlargement of the distal interphalangeal joints. What is the most likely diagnosis? *(p 466)* _____

_____

28. A 36-year-old woman presents to the clinic with a new complaint of fatigue for several months. She also reports stiffness in both hands in the morning, which decreases after showering. Physical examination reveals a low-grade fever, and subcutaneous nodules are palpated along her forearms bilaterally. What is the most likely diagnosis? *(p 466)* _____

_____

29. A 50-year-old obese man comes to the emergency room at 3 a.m. because of a painful big toe. The pain began 5 hours earlier, after he walked home from a bar where he had steak and beer. He is allergic to NSAIDs. What is the most appropriate treatment? *(p 467)* _____

_____

30. In the chart below, compare and contrast gout and calcium pyrophosphate deposition disease (previously called pseudogout). *(p 467)*

	Gout	Calcium pyrophosphate deposition disease
Sexual predilection		
Joint most often affected		
Crystal composition		
Crystal shape		
Birefringence		
Treatment		

31. An 11-year-old boy presents with pain in his knees and ankles, along with daily spiking fevers, and a salmon-pink macular rash on his trunk. What is a likely diagnosis? *(p 468)* _____

_____

32. What are the four symptoms of Sjögren syndrome? What are the two common antiribonucleoprotein antibodies found in these patients? *(p 468)* _____

_____

_____

33. List three causes of septic arthritis. *(p 468)* _____

_____

34. A 27-year-old man presents with a 6-month history of low back pain and stiffness that is worse in the morning and improves with movement. He has tenderness over his sacroiliac joints bilaterally and decreased motion of his lumbar spine. What is the most likely diagnosis? *(p 469)* _____

_____

35. A 31-year-old man goes to the emergency room because his eyes have been red and itchy for the past 8 hours. For the past month, he has experienced painful urination and diffuse joint pain. Three weeks earlier he tested positively for gonorrhea and chlamydia. Tests are negative for rheumatoid factor. What is the most likely diagnosis? *(p 469)* _____

_____

36. A 17-year-old girl complains of fever and a painful swollen left elbow. In addition, she has had pain in her right knee for the past several days. Her cheeks are slightly red but not tender. Her VDRL test result is positive. She is shocked to learn that she has syphilis because she has no sexual history. What is the most likely explanation for this finding? *(p 470)* _____

_____

37. In Lambert-Eaton myasthenic syndrome, symptoms _____ (improve/worsen) with muscle use. In myasthenia gravis, symptoms _____ (improve/worsen) with muscle use. *(p 472)*

38. Acetylcholinesterase (AChE) inhibition _____ (reverses/has minimal effect on) symptoms in Lambert-Eaton myasthenic syndrome and _____ (reverses/does not reverse) symptoms in myasthenia gravis. *(p 472)*

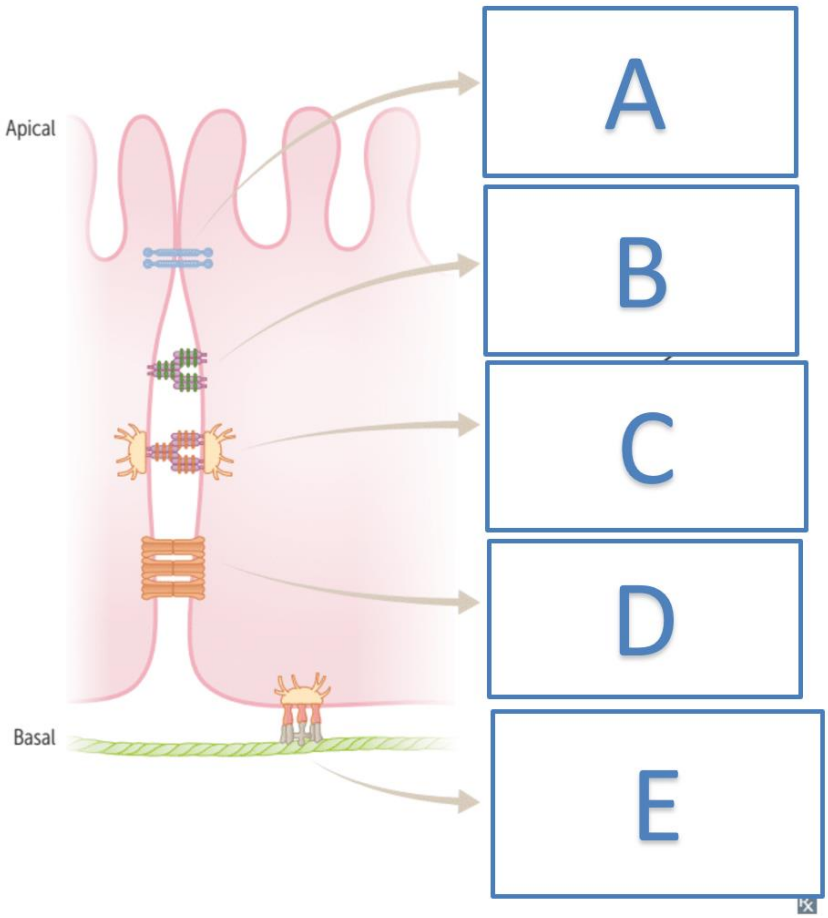
39. What does CREST stand for, and with what antibody is it associated? *(p 473)* _____

_____

_____

DERMATOLOGY

40. Identify the structures in the image below. *(p 474)*



41. Match the dermatologic term with its definition. *(p 475)*

_____ A. Vesicle containing pus
_____ B. Dry exudate
_____ C. Elevated solid skin lesion < 1 cm
_____ D. Epidermal hyperplasia
_____ E. Flat discolored lesion < 1 cm
_____ F. Inflammation of skin
_____ G. Large, fluid-filled blister > 1 cm
_____ H. Macule > 1 cm
_____ I. Papule > 1 cm
_____ J. Separation of epidermal cells
_____ K. Small, fluid-filled blister < 1 cm
_____ L. Transient smooth papule or plaque

1. Acantholysis
2. Acanthosis
3. Bulla
4. Crust
5. Dermatitis
6. Macule
7. Papule
8. Patch
9. Plaque
10. Pustule
11. Vesicle
12. Wheal

42. With what disease is seborrheic dermatitis associated? *(p 476)* _____

43. Match the skin disorder with its defining characteristic(s). *(pp 476-477, 479-482)*

_____ A. Areas of complete depigmentation
_____ B. Associated with insulin resistance
_____ C. Auspitz sign
_____ D. Genital warts
_____ E. Honey-colored crusts
_____ F. Horn cysts
_____ G. Infection of dermis and subcutaneous tissues
_____ H. Infection of stratum granulosum
_____ I. Pruritic wheals
_____ J. Nikolsky sign negative
_____ K. Normal melanocyte number, ↓ melanin
_____ L. Potentially fatal
_____ M. Premalignant lesions
_____ N. Target lesion
_____ O. Pruritic eruptions in antecubital fossa

1. Acanthosis nigricans
2. Actinic keratosis
3. Albinism
4. Bullous pemphigoid
5. Cellulitis
6. Condyloma acuminatum
7. Eczema (Atopic dermatitis)
8. Erythema multiforme
9. Hives (Urticaria)
10. Impetigo
11. Pemphigus vulgaris
12. Psoriasis
13. Seborrheic keratosis
14. Staphylococcal scalded skin
15. Vitiligo

44. In the chart below, compare and contrast the characteristics of bullous pemphigoid and pemphigus vulgaris. *(p 480)*

Characteristic	Bullous Pemphigoid	Pemphigus Vulgaris
Pattern of immunofluorescence		
Location of blisters		
Oral involvement		
Nikolsky sign		

45. With which GI disease is dermatitis herpetiformis associated? *(p 481)* _____

46. One entire leg accounts for _____% of total body surface area, while one entire arm accounts for _____% of total body surface area. *(p 483)*

47. Superficial partial-thickness burns occur _____ (with/without) pain, while full-thickness burns occur _____ (with/without) pain. *(p 483)*

48. What is the most common type of skin cancer? *(p 484)* _____

49. Name a tumor marker of melanoma. *(p 484)* _____

50. What type of skin cancer may benefit from vemurafenib? *(p 484)* _____

51. Actinic keratosis is a precursor to _____ (melanoma/squamous cell carcinoma), while dysplastic nevus is associated with _____ (melanoma/squamous cell carcinoma). *(p 484)*

PHARMACOLOGY

52. In the arachidonic acid pathways *(p 485)*:

    A. Phospholipase A_2 facilitates the conversion of _____ into _____

    _____.

    B. 5-Lipoxygenase facilitates the conversion of _____ into _____

    _____.

    C. Cyclooxygenase facilitates the conversion of _____ into _____

    _____.

53. What is the mechanism of action of acetaminophen? *(p 485)* _____

    _____

54. What is the mechanism of action of aspirin? *(p 486)* _____

    _____

55. What is the mechanism of action of NSAIDs? *(p 486)* _____

    _____

56. Why should a person who takes NSAIDs consider switching to a COX-2 inhibitor? What is the risk of COX-2 inhibitors? *(p 486)* _____

    _____

    _____

57. What is the mechanism of action of bisphosphonates? *(p 486)* _____

_____

Answers

ANATOMY AND PHYSIOLOGY

1.

Lesion	Injured Nerve(s)	Presentation	Affected Muscle(s)
Ape hand	Recurrent branch of median nerve; C5-T-1	Unopposable thumb	Opponens pollicis
Erb palsy	Upper trunk; C5-C6 nerve roots	Arm hangs by side, arm medially rotated, arm extended and pronated	Deltoid, supraspinatus, Infraspinatus, biceps brachii
Klumpke palsy	Lower trunk; C8-T1 nerve roots	Claw hand: lumbricals normally flex MCP joints and extend DIP and PIP joints	Intrinsic hand muscles: lumbricals, interossei, thenar, hypothenar
Median claw	Distal median nerve	Second/third fingers clawed	Lateral lumbricals
Ulnar claw	Distal ulnar nerve; C-8-T-1	“Pope’s blessing” when asked to extend fingers	Medial lumbricals

2. Axillary (C5-C6) nerve damage leads to loss of sensation over the deltoid muscle and lateral arm.

3. Radial (C5-T1) nerve damage leads to loss of sensation over the posterior arm/forearm and dorsal hand. She also has loss of elbow, wrist, and finger extension and low grip strength.

4. This patient likely injured his ulnar nerve. Therefore, he has lost function of the flexors on the ulnar portion of his wrist, but has retained the flexors innervated by the median nerve, which are on the radial aspect of the hand. Hence, when the functioning flexors are activated, they cause radial deviation.

5. Hip dislocation, causing damage to the obturator nerve.

6. Pelvic fracture, causing damage to the femoral nerve.

7. The man has likely injured the common peroneal nerve. Sensory deficit would occur in the webspace between the hallux and second digit as well as dorsum of the foot, resulting in “steppage gait” or foot drop.

8. Posterior hip dislocation, causing injury to the inferior gluteal nerve.

9. Difficulty with foot inversion and plantar/toe flexion due to damage to the tibial nerve.

10. MCL; ACL.

11. Anterior talofibular ligament.

12. Lateral thoracic artery.

13. The tibial nerve and popliteal artery.

14. Type I; type II.

15. Muscle spindles; Golgi tendon organ.

16. Osteoblasts build bone by secreting collagen and catalyzing mineralization in alkaline environment via ALP; osteoclasts dissolve bone by secreting H^+ and collagenases.

17. At low, intermittent levels, PTH exerts anabolic effects (building bone) on osteoblasts and osteoclasts (indirect). Chronically high PTH levels cause catabolic effects, including osteitis fibrosa cystica.

PATHOLOGY

18. Metacarpal neck fracture.

19. Carpal tunnel syndrome; Guyon canal syndrome.

20. Clavicle fracture; fractures at the middle third segment are most common.

21. Medial meniscus, ACL, MCL.

22. Bone resorption that outpaces bone formation in tibial cortex.

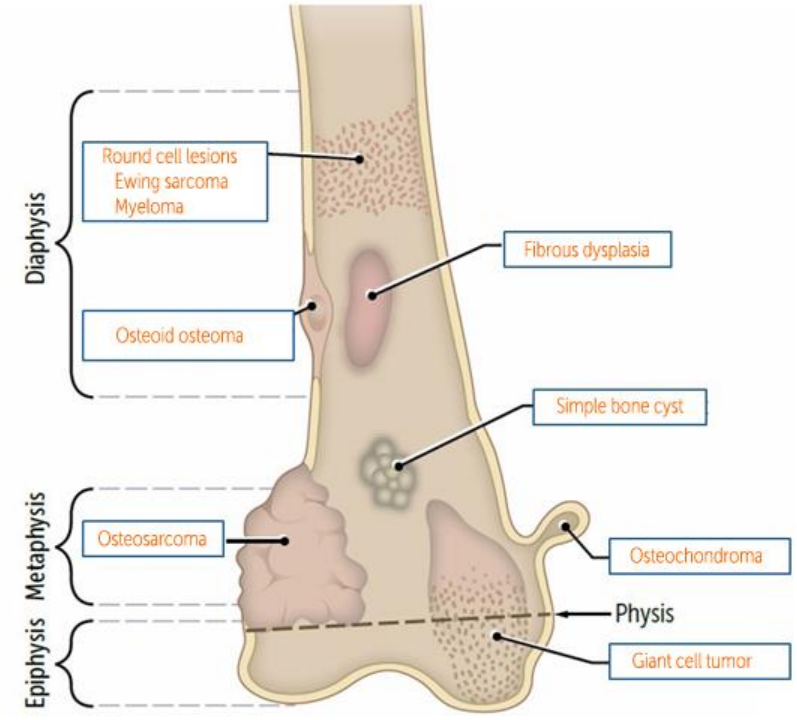
23. Developmental dysplasia of the hip is tested with Ortolani and Barlow maneuvers, as the manipulation of newborn hip reveals a "clunk." Diagnosis is confirmed via ultrasound. An x-ray would not be used until approximately 4-6 months of age, as cartilage is not ossified before then.

24.

Condition	ALP	PO_4^{3-}	PTH	Serum Ca^{2+}
Osteitis fibrosa cystica, primary hyperparathyroidism	↑	↓	↑	↑
Osteitis fibrosa cystica, secondary hyperparathyroidism	↑	↑	↑	↓
Osteomalacia/rickets	↑	↓	↑	↓
Osteopetrosis	Normal	Normal	Normal	Normal/↓
Osteoporosis	Normal	Normal	Normal	Normal
Paget disease of bone.	↑	Normal	Normal	Normal

25. Paget disease of bone.

26.



27. Osteoarthritis.

28. Rheumatoid arthritis.

29. This patient has gout; treat with colchicine or glucocorticoids if NSAIDs are contraindicated.

30.

	Gout	Calcium pyrophosphate deposition disease
Sexual predilection	Men	None
Joint most often affected	MTP joint of big toe	Knee
Crystal composition	Monosodium urate	Calcium pyrophosphate
Crystal shape	Needle	Rhomboid
Birefringence	Negative	Weakly positive
Treatment	NSAIDs (eg, indomethacin), colchicine, glucocorticoids	NSAIDs, colchicine, glucocorticoids

31. Systemic juvenile idiopathic arthritis.

32. Inflammatory joint pain, keratoconjunctivitis sicca, xerostomia, and bilateral parotid enlargement. SS-A (anti-Ro) and/or SS-B (anti-La).

33. *Staphylococcus aureus, Streptococcus*, and *Neisseria gonorrhoeae*.

34. Ankylosing spondylitis.

35. Reactive arthritis (formerly called Reiter syndrome).

36. She has antiphospholipid syndrome, secondary to lupus. This can cause false-positive VDRL results, as well as the additional symptoms presented.

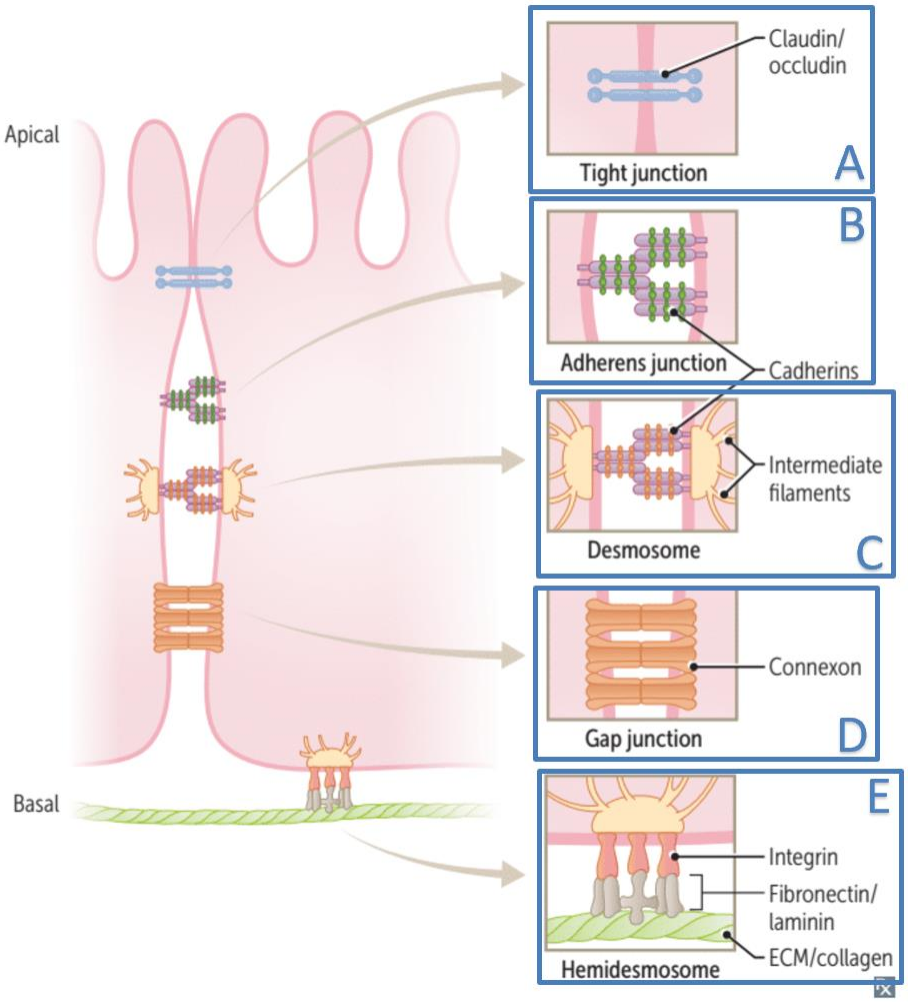
37. Improve; worsen.

38. Has minimal effect on; reverses.

39. **C**alcinosis cutis, **R**aynaud phenomenon, **E**sophageal dysmotility, **S**clerodactyly, and **T**elangiectasia. Associated with anticentromere antibody.

DERMATOLOGY

40.



41. A-10, B-4, C-7, D-2, E-6, F-5, G-3, H-8, I-9, J-1, K-11, L-12.

42. Parkinson disease.

43. A-15, B-1, C-12, D-6, E-10, F-13, G-5, H-14, I-9, J-4, K-3, L-11, M-2, N-8, O-7.

44.

Characteristic	Bullous Pemphigoid	Pemphigus Vulgaris
Pattern of immunofluorescence	Linear	Reticular
Location of blisters	Subepidermal	Intraepidermal
Oral involvement	No	Yes
Nikolsky sign	Negative	Positive

45. Celiac disease.

46. One entire leg accounts for **18%** of total body surface area, while one entire arm accounts for **9%** of total body surface area.

47. With; without.

48. Basal cell carcinoma.

49. S-100 tumor marker.

50. Melanoma patients with unresectable or metastatic disease with *BRAF* V600E mutation.

51. Squamous cell carcinoma; melanoma.

PHARMACOLOGY

52. A = Phospholipase A_2 facilitates the conversion of **membrane phospholipids** into **arachidonic acid**. B = 5-Lipoxygenase facilitates the conversion of **arachidonic acid** into **hydroperoxides** (which then get converted into leukotrienes). C = Cyclooxygenase facilitates the conversion of **arachidonic acid** into **cyclic endoperoxides** (which then get converted into prostacyclin, prostaglandins, and thromboxane).

53. Acetaminophen causes reversible inhibition of cyclooxygenase, mostly in the CNS.

54. Aspirin causes irreversible inhibition of cyclooxygenase.

55. NSAIDs cause reversible inhibition of cyclooxygenase and block prostaglandin synthesis.

56. Many people who take NSAIDs suffer from gastrointestinal distress and ulcer formation, which can be avoided by using COX-2 inhibitors. COX-2 inhibitors do, however, increase the risk of thrombosis. Patients with sulfa allergy should not take this medication.

57. Pyrophosphate analogs; bind hydroxyapatite in bone to inhibit osteoclast activity.

Pathology

Questions

CELLULAR INJURY

1. Define the following terms. *(p 206)*

   A. Hyperplasia_____

   _____

   B. Metaplasia _____

   _____

   C. Dysplasia _____

   _____

2. Describe the fundamental differences between the intrinsic and extrinsic pathways of apoptosis. Name two important similarities between the pathways. *(p 208)* _____

   _____

   _____

   _____

3. Describe the fundamental differences between apoptosis and necrosis. What are the six types of necrosis? Give an example of each. *(pp 208-209)* _____

   _____

   _____

   _____

4. Name three organs that manifest irreversible ischemia with red infarcts. Name two that show pale infarcts. *(p 210)* _____

_____

5. What are the four ways that free radicals can be eliminated? Under what conditions might these mechanisms fail? *(p 210)* _____

_____

_____

6. What type of linear sheets are amyloid proteins aggregated in? What type of stain is used to visualize the amyloid proteins? *(p 212)* _____

7. What types of fibril proteins are seen in primary-, secondary- and dialysis-related amyloidosis? Which disease is β-amyloid protein seen in? *(p 212)* _____

_____

INFLAMMATION

8. What are the differences between positive and negative acute phase reactants? Give examples of each. *(p 213)* _____

_____

_____

9. What are the cardinal signs of inflammation and how would they manifest systemically? *(p 213)* __

_____

_____

_____

10. What conditions are associated with a low erythrocyte sedimentation rate? *(p 214)* _____

_____

11. Which cells and proteins mediate the acute phase of inflammation? *(p 214)* _____

_____

_____

12. In the chart below, compare and contrast each step of leukocyte extravasation. *(p 215)*

Step	Vasculature/ Stroma	Leukocytes
Margination and rolling		
Tight binding (adhesion)		
Diapedesis (transmigration)		
Migration		

13. In cases of chronic inflammation, what types of cells infiltrate tissue? What is the key cell of granulomas? *(pp 216-217)* _____

_____

NEOPLASIA

14. Compare and contrast the characteristics of benign and malignant tumors. *(p 220)*

Characteristic	Benign Tumor	Metastatic Tumor
Differentiation		
Growth		
Boundaries		
Metastatic potential		

15. Describe the differences between tumor grade and tumor stage. *(p 220)* _____

_____

_____

_____

16. Match each hallmark of cancer with its mechanism: *(p 221)*

_____ A. Limitless replicative potential	1. Mutations in tumor suppressor genes
_____ B. Tissue invasion	2. Shift of glucose metabolism toward glycolysis
_____ C. Metastasis	3. Reactivation of telomerase
_____ D. Anti-growth signal insensitivity	4. Mutations in proto-oncogenes
_____ E. Warburg effect	5. Loss of E-cadherin function
_____ F. Growth signal self-sufficiency	6. Tumor cells spread via lymphatics or blood

17. Explain the mechanisms by which cancer evades the immune system. *(p 221)* _____

_____

_____

_____

18. What are the two interactions required by antigen-presenting cells when presenting tumor antigens to T cells? *(p 222)* _____

_____

19. Which receptor on the T cell does Ipilimumab target? What is the function of this protein under normal circumstances? *(p 222)* _____

_____

20. Which cancers are most common in men? In women? What is the overall leading cause of death in the United States? *(p 222)* _____

_____

21. Oncogenes are associated with a _____ (gain/loss) of function and require damage to _____ (one/both) allele(s) of a proto-oncogene. Examples include _____. In contrast, tumor suppressor genes are associated with a _____ (gain/loss) of function and require damage to _____ (one/both) allele(s) for expression of disease. Examples include _____. *(p 224)*

22. A 70-year-old who eats smoked seafood every day presents with abdominal pain and loss of appetite. Which diagnosis should be high on the differential? *(p 225)* _____

23. A 55-year-old woman with a 40-pack-year history of cigarette smoking presents with new-onset cough, hemoptysis, and highly concentrated urine. What diagnosis should be high on the differential? *(pp 225, 228*) _____

_____

24. A 40-year-old otherwise healthy man is diagnosed with nasopharyngeal carcinoma. He does not smoke or drink. What is the most likely cause of his cancer? *(p 226)* _____

25. How are tumor markers best used? *(p 226)* _____

_____

26. An IV drug abuser who is being monitored for cirrhosis shows a sudden increase in his α-fetoprotein level. For which disease is he at increased risk? *(pp 226-227)* _____

_____

27. Match the site of metastatic tumor with the immunohistochemical stain used to locate its origin. *(p 227)*

_____ A. Chromogranin and synaptophysin	1. Astrocytes
_____ B. Cytokeratin	2. Epithelial cells
_____ C. Desmin	3. Mesenchymal tissue
_____ D. GFAP	4. Muscle
_____ E. Neurofilament	5. Neural crest cells
_____ F. PSA	6. Neuroendocrine cells
_____ G. S-100	7. Neurons
_____ H. TRAP	8. Prostatic epithelium
_____ I. Vimentin	9. Tartrate-resistant acid phosphatase

28. Match the neoplasm(s) to the tumor(s) with which it is most commonly associated. *(p 228)*

_____ A. Anti-NMDA receptor encephalitis	1. Gastric adenocarcinoma
_____ B. Cushing syndrome	2. Lymphoma
_____ C. Acanthosis nigricans	3. Neuroblastoma in children
_____ D. Hypercalcemia + elevated calcitriol level	4. Ovarian teratoma
_____ E. Myasthenia gravis	5. Pancreatic adenocarcinoma
_____ F. Opsoclonus-myoclonus ataxia syndrome	6. Renal cell carcinoma
_____ G. Polycythemia	7. Small cell lung cancer
_____ H. Trousseau syndrome	8. Thymoma

Answers

CELLULAR INJURY

1. A. Hyperplasia: controlled proliferation of stem cells and differentiated cells → increase in the number of cells.

   B. Metaplasia: reprogramming of stem cells → one type of cell is replaced by another that can adapt to a new stress.

   C. Dysplasia: disordered, precancerous epithelial cell growth.

2. The intrinsic pathway involves the use of intrinsic proteins BAX and BAK, regulated by p53 protein, which activates the apoptotic pathway via release of mitochondrial initiation caspases. There are two extrinsic pathways: ligand receptor interactions and immune cell (cytotoxic T-cell release of perforin and granzyme B). Similarities: both require ATP, and both activate caspases (cytosolic proteases).

3. Apoptosis occurs without significant inflammation, whereas necrosis causes local inflammation. The six types of necrosis are coagulative (ischemia/infarcts in most tissues), liquefactive (bacterial abscesses, brain infarcts), caseous (TB, systemic fungal infection), fat (enzymatic: saponification of peripancreatic fat; nonenzymatic: traumatic), fibrinoid (immune and nonimmune vascular reactions), and gangrenous (distal extremity and GI tract, after chronic ischemia).

4. Red infarcts: liver, lungs, testes, and intestine. Pale infarcts: heart and kidney.

5. By scavenging enzymes (eg, catalase, superoxide dismutase, and glutathione peroxidase), spontaneous decay, antioxidants (eg, vitamins A, C, and E), and certain metal carrier proteins (eg, transferrin and ceruloplasmin). Deficiencies in free radical elimination can occur in individuals with genetic mutations that result in abnormal/absent enzymes, or with vitamin deficiencies.

6. β-pleated; Congo red stain.

7. Primary: AL from Ig light chains, secondary: serum amyloid A (AA), dialysis-related: β_2-microglobulin. β-amyloid protein seen in Alzheimer disease.

INFLAMMATION

8. Positive (upregulated): These are upregulated during acute inflammatory state. More **FFiSH** in the **C** (sea). **F**erritin, **F**ibrinogen, **S**erum amyloid A, **H**epcidin, **C**-reactive protein. Negative (downregulated): albumin and transferrin.

9. Rubor (redness), calor (warmth) – vasodilation → increased blood flow; Tumor (swelling) – endothelial contraction/disruption → increased vascular permeability → leakage of protein-rich fluid from postcapillary venules into interstitial space (exudate) → increased interstitial oncotic pressure. Dolor (pain) – sensitization of sensory nerve endings; Functio laesa (loss of function) – cardinal signs above impair function.

10. Sickle cell anemia (altered shape), polycythemia, heart failure, microcytosis, and hypofibrinogenemia, among others.

11. Neutrophils, eosinophils, antibodies (pre-existing), mast cells, basophils, toll-like receptors, arachidonic acid metabolites, complement, and Hageman factor (factor XII).

12.

Step	Vasculature/ Stroma	Leukocytes
Migration and rolling	E-selectin P-selectin GlyCAM-1, CD34	Sialyl Lewis^X Sialyl Lewis^X L-selectin
Tight binding (adhesion)	ICAM-1 (CD54) VCAM-1 (CD106)	CD11/18 integrins (LFA-1, Mac-1) VLA-4 integrin
Diapedesis (transmigration)	PECAM-1 (CD31)	PECAM-1 (CD31)
Migration	Chemotactic factors: C5a, IL-8, LTB_4, kallikrein, platelet-activating factor	Various

13. Mononuclear cells, including macrophages, lymphocytes, and plasma cells. The key cell of granulomas is epithelioid cells (activated macrophages with abundant pink cytoplasm).

NEOPLASIA

14.

Characteristic	Benign Tumor	Metastatic Tumor
Differentiation	Well-differentiated	May show poor differentiation
Growth	Slow	Erratic
Boundaries	Well-demarcated	Diffuse or locally invasive
Metastatic potential	No	Yes

15. Tumor grade is the degree of cellular differentiation and mitotic activity on histology. It ranges from low grade (well-differentiated) to high grade (poorly differentiated, undifferentiated, or anaplastic). In contrast, tumor stage describes the degree of localization/extent of tumor spread within a patient based on the site and size of the primary lesion, spread to regional lymph nodes, and presence of metastases. Stage is a better indicator of a patient's prognosis than is tumor grade.

16. A-3, B-5, C-6, D-1, E-2, F-4.

17. Loss of MHC class I expression by tumor cells, making cytotoxic T cells unable to recognize tumor cells. Tumor cells secrete immunosuppressive factors (eg, TGF-β) and recruit regulatory T cells to down regulate immune response. Tumor cells up regulate immune checkpoint molecules (eg, PD-1, CTLA-4), which inhibit immune response.

18. T cells need two signals to be activated. First, the MHC-I molecule with antigen presented on board interacts with the TCR; second, co-signal by B7 and CD28.

19. CTLA-4. Under normal circumstances, it outcompetes CD28 for B7 on APCs and prevents co-stimulatory signal leading to T cell downregulation.

20. Prostate, lung, and colon/rectum cancers are the most common cancers in men; breast, lung, and colon/rectum cancers are the most common in women. The overall leading cause of death in the United States is cardiovascular disease.

21. Oncogenes are associated with a **gain** of function and require damage to **one** allele of a proto-oncogene. Examples include ***c-MYC*** (Burkitt lymphoma) **and *KRAS*** (colon, lung, and pancreatic cancers). In contrast, tumor suppressor genes are associated with a **loss** of function and require damage to **both** alleles for expression of disease; Examples include ***NF1*** (neurofibromatosis type 1) **and *BRCA1/2*** (breast, ovarian, and pancreatic cancers).

22. Gastric cancer. Smoked foods contain large amounts of nitrosamine.

23. Small cell lung carcinoma secreting ADH causing hyponatremia (SIADH). SIADH = syndrome of inappropriate ADH secretion.

24. Epstein-Barr virus (EBV).

25. To monitor tumor recurrence and response to therapy. (Definitive diagnosis is made via biopsy.)

26. Hepatocellular carcinoma. IV drug use is associated with HCV. HCV is associated with cirrhosis and HCC.

27. A-6, B-2, C-4, D-1, E-7, F-8, G-5, H-9, I-3.

28. A-4, B-7, C-1, D-2, E-8, F-3, G-6, H-5.

Public Health Sciences

Questions

EPIDEMIOLOGY AND BIOSTATISTICS

1. A case-control study is _____ (experimental/observational) and _____ (prospective/retrospective). *(p 256)*

2. A cohort study is _____ (experimental/observational) and _____ (prospective/retrospective/prospective or retrospective). *(p 256)*

3. True or False: In a cohort study, subjects are chosen on the basis of the presence or absence of risk factors. *(p 256)* _____

4. True or False: A cohort study may involve following subjects over a period of time to study the development of disease. *(p 256)* _____

5. True or False: A cross-sectional research study can show the correlation of a risk factor with a disease. *(p 256)* _____

6. Describe double- and triple-blinded studies. *(p 256)* _____

   _____

   _____

7. What is the purpose of Phase III clinical trials? *(p 256)* _____

   _____

8. How does a low prevalence of disease affect the positive predictive value of a test? *(p 257)*

   _____

9. Screening tests (eg, the ELISA in HIV testing) are _____ (sensitive/specific) and have a high false-_____ (negative/positive) rate, with a _____ (high/low) threshold. *(p 257)*

10. Confirmatory testing (eg, a Western blot in HIV testing) is _____ (sensitive/specific) and has a high false-_____ (negative/positive) rate, with a _____ (high/low) threshold. *(p 257)*

11. How does a low prevalence of disease affect the negative predictive value of a test? *(p 257)* _____

    _____

12. If a diagnostic test has 100% sensitivity, what should the value of the false-negative rate equal? *(p 257)* _____

13. If a diagnostic test has 100% specificity, what should the value of the false-positive rate equal? *(p 257)* _____

14. The statement "Patients with COPD were more likely to have a history of smoking than those without COPD" pertains to _____ (odds ratio/relative risk). *(p 258)*

15. The statement "Smokers were more likely to develop COPD than nonsmokers" pertains to _____ (odds ratio/relative risk). *(p 258)*

16. True or False: An odds ratio represents the odds of a given exposure among cases versus the odds of that exposure among controls. *(p 258)* _____

17. How is the relative risk reduction calculated? *(p 258)* _____

18. What epidemiologic measurement gives the difference in disease risk between an exposed group and an unexposed group? *(p 258)* _____

19. What measure of disease frequency is calculated by dividing the number of existing cases in the population at a given time by the total number of people in the population at that time? *(p 259)*

    _____

20. What measure of disease frequency is calculated by dividing the number of new cases in the population per unit of time by the number of people at risk during that time? *(p 259)*

    _____

21. In chronic disease states, such as diabetes, is the prevalence of disease greater than, less than, or equal to the incidence? *(p 259)* _____

22. In acute disease states, such as a common cold, is the prevalence of disease greater than, less than, or equal to the incidence? *(p 259)* _____

23. True or False: When calculating the incidence of a disease, the total population at risk during a certain time should include people who have the disease. *(p 259)* _____

24. _____ (Precision/Accuracy) describes how close a test result is to the true value. It is reduced by _____ (random/systematic) error; while _____ (precision/accuracy) describes how close a test result is to other test results, or how consistent/reproducible each test result is. It is reduced by _____ (random/systematic) error. *(p 259)*

25. An ROC curve plots the _____ of each test result on the x-axis and the _____ of each test result on the y-axis. The area under the curve (AUC) represents the _____ of a test. *(p 260)*

26. What is the name of the phenomenon whereby a researcher's belief in the efficacy of a treatment changes the outcome of that treatment? *(p 260)* _____

27. What is a good strategy to reduce lead-time bias in epidemiology studies? *(p 261)* _____
_____

28. What type of bias occurs when a factor is related to both exposure and outcome, therefore distorting or confusing the effect of the exposure on the outcome? *(p 261)* _____
_____

29. In a data set that has a distribution with a negative skew, what is the relationship between the mean, the median, and the mode? *(p 262)* _____

30. In a data set that has a distribution with a positive skew, what is the relationship between the mean, the median, and the mode? *(p 262)* _____

31. Which characteristic is least affected by outliers: mean, median, or mode? *(p 262)* _____

32. What is the term for the hypothesis that there is no association between the variables being studied? *(p 262)* _____

33. In a data set that has a normal (Gaussian) distribution, what percentage of the data falls within two standard deviations (SD) of the mean? What percentage falls within three SDs of the mean? *(p 262)*
_____

34. In statistical calculations, *α* is equal to the probability of making what type of error? *(p 263)*

_____

35. In a statistical analysis, if $p = 0.03$, what is the probability that the data will show a difference by chance alone when none truly exists? *(p 263)* _____

36. In statistical analysis, if $\beta = 0.2$, what is the probability that the null hypothesis has been falsely accepted? *(p 263)* _____

37. The power of a statistical test depends on which three factors? *(p 263)* _____

_____

38. What study parameter is calculated when the probability of making a type II error is subtracted from 1? *(p 263)* _____

39. If the 95% confidence interval for a mean difference between two variables includes zero, the null hypothesis _____ (is/is not) rejected. *(p 263)*

40. What type of statistical analysis pools summary data from multiple studies for a more precise estimate of the size of an effect? *(p 264)* _____

41. What type of statistical test is used to check for a difference between the means of three or more groups? *(p 264)* _____

42. What type of statistical test is used to check for a difference between the means of two groups? *(p 264)* _____

43. What statistical term's absolute value indicates the strength of the correlation between two variables? *(p 264)* _____

ETHICS

44. What are the four core ethical principles of medicine? *(p 265)* _____

_____

45. True or False: Patient autonomy may conflict with beneficence. *(p 265)* _____

46. Which right is being exercised when a patient makes an informed decision to proceed with a medical treatment when the benefits of the intervention outweigh its risks? *(p 265)*

_____

47. What four steps are required for informed consent? *(p 265)* _____

_____

48. What are the four exceptions to informed consent? *(p 265)* _____

_____

_____

49. Name three conditions in which a minor may be considered emancipated. *(p 265)*

_____

_____

50. What six requirements must be met in order to determine that a patient has full decision-making capacity? *(p 266)* _____

_____

_____

51. What term refers to an incapacitated patient's prior oral statements, which are commonly used to guide medical decisions? *(p 266)* _____

52. What four factors give greater validity to a patient's oral advance directive? *(p 266)* _____

_____

_____

53. What is the term for the legal document that describes specific healthcare interventions that a patient anticipates he or she would accept or reject during treatment for critical or life-threatening illness?

(p 266) _____

54. What legal term refers to the person that a patient has designated to make medical decisions in the event that the patient loses decision-making capacity? *(p 266)* _____

55. True or False: When authorizing a medical power of attorney, the patient may specify decisions that are to be made in certain clinical situations. *(p 266)* _____

56. True or False: A patient's agent authorized with medical power of attorney retains that power unless it is revoked by the patient. *(p 266)* _____

57. Which type of advance directive provides greater flexibility, a living will or a medical power of attorney? *(p 266)* _____

58. When a patient is incapacitated or the situation is emergent, how should a physician approach disclosing protected patient information to the patient's family and friends? *(p 267)*

_____

_____

59. What are the four general exceptions to maintaining patient confidentiality? *(p 267)* _____

_____

_____

60. In the case of certain serious infectious diseases, a physician may have a duty to breach patient confidentiality in order to warn which group of people? *(p 267)*

_____

_____

61. A child presents to the emergency department with multiple fractures and bruises of different ages. The patient's mother requests that authorities not be involved. Must the physician respect her request for confidentiality? Why or why not? *(p 267)* _____

_____

62. A young woman confides to her physician that she has considered ending her life by ingesting a bottle's worth of her prescription pills, and that she does not want anyone else to know of her plan. Must the physician respect her request for nondisclosure? Why or why not? *(p 267)* _____

_____

63. A patient discloses that he frequently drives after consuming four or five drinks at the bar. In the office, the patient clearly has been drinking alcohol and has arrived on his own. Is the physician obligated to uphold confidentiality? Why or why not? *(p 267)* _____

_____

64. True or False: A patient's family can require that a doctor withhold information from the patient.

(p 268) _____

65. What is an appropriate response to a patient who is upset about how he or she was treated by another doctor? *(p 268)* _____

_____

66. What is an appropriate response to a patient who is nonadherent? *(p 268)*

_____

_____

67. What is an appropriate response to a 17-year-old girl who is pregnant and requests an abortion? *(p 268)* _____

_____

68. What is an appropriate response to a terminally ill patient who requests physician assistance with ending his or her life? *(p 268)* _____

_____

69. What is an appropriate response to a patient who desires an unnecessary procedure? *(p 268)*

_____

_____

70. What is an appropriate response to a patient who states that he or she finds you attractive? *(p 268)* _____

_____

THE WELL PATIENT

71. What sexual changes normally occur in elderly men? *(p 270)* _____

_____

HEALTHCARE DELIVERY

72. Give an example of primary, secondary, and tertiary disease prevention strategies. *(p 270)* _____

_____

73. Match the following healthcare payment models with their descriptions. (*p 271)*

_____	A. Capitation	1.	Patient pays for all expenses for an incident of care
_____	B. Discounted fee-for-service	2.	Physician receives set payment for each patient
_____	C. Global payment	3.	Patient pays for each service at a predetermined discounted rate
_____	D. Bundled payment	4.	Patient pays for each individual service
_____	E. Fee-for-service	5.	Healthcare organization receives a set amount per service, regardless of ultimate cost

74. What two federally funded healthcare programs originated from amendments to the Social Security Act? Who is eligible for these programs? *(p 272)* _____

_____

75. What is the most common cause of death in young adults? *(p 272)* _____

76. What is the most frequent cause of readmissions for those with Medicaid? *(p 272)* _____

_____

QUALITY AND SAFETY

77. Match the following quality measurements with their examples. *(p 273)*

_____ A. Outcome 1. % of diabetic patients whose HbA_{1c} was measured in the past 6 months

_____ B. Process 2. Incidence of hypoglycemia among patients who tried an intervention to lower HbA_{1c}

_____ C. Balancing 3. Average HbA_{1c} of patients with diabetes

_____ D. Structural 4. Number of diabetes educators

78. Complete the following Process improvement model. *(p 273)*

P_____

D_____

S_____

A_____

79. Patient misidentification is an example of _____ (active/latent) error. *(p 274)*

80. _____ is prolonged, excessive stress that can lead to cynicism, detachment, decreased motivation, decreased interest and a sense of helplessness. Medical errors may occur due to _____. _____ is sleep deprivation leading to decreased energy, decreased motivation and cognitive impairment. Medical errors may occur due to _____. *(p 274)*

81. Root cause analysis is a _____ (prospective/retrospective) approach to analyzing medical error. *(p 274)*

Answers

EPIDEMIOLOGY AND BIOSTATISTICS

1. Observational; retrospective (Asks “what happened?”).
2. Observational; prospective (more common) or retrospective.
3 True.
4. True (for prospective cohort studies).
5. True (However, it cannot show causality.)
6. In double-blinded studies, neither doctors nor patients know whether the patient is in the treatment or control group. In triple-blinded studies, doctors, patients, and researchers analyzing the data are unaware of study-group assignment.
7. To compare the efficacy of the new treatment with the current standard of care.
8. The positive predictive value of the test is lower for a disease that has a lower prevalence.
9. Sensitive; positive; low.
10. Specific; negative; high.
11. The negative predictive value of the test is higher for a disease that has a lower prevalence.
12. It should equal 0. (All cases of the disease are detected by the test.)
13. It should equal 0. (All patients without the disease are identified correctly.)
14. Odds ratio.
15. Relative risk.
16. True.
17. Relative risk reduction (RRR) = 1 – Relative risk (RR) = 1 – [a/(a+b)]/[c/(c+d)]
18. Attributable risk; it is the percentage of cases of a disease caused by a risk factor.
19. Prevalence.

20. Incidence. (Incidence refers to new incidents.)

21. Greater than the incidence (because of the large number of existing cases of the disease).

22. Approximately equal (for diseases of short duration).

23. False. (The total population at risk during a certain period should not include people who have the disease because incidence is a measure of new cases of a disease; those who have the disease are not at risk of getting the disease.)

24. Accuracy; systematic error; precision; random error.

25. False positive rate (1 - specificity); true positive rate (sensitivity); accuracy.

26. Observer-expectancy bias or Pygmalion effect.

27. Measure “back-end” survival by adjusting survival according to the severity of disease at the time of diagnosis.

28. Confounding bias, in which the causal relationship may be better explained by a variable other that the one being studied.

29. Mean < median < mode.

30. Mean > median > mode.

31. Mode.

32. Null hypothesis.

33. 95% fall within 2SDs of the mean, and 99.7% fall within 3SDs of the mean.

34. Type I error (α). This type of error occurs when it is incorrectly concluded that an association is present when no association exists.

35. 3%.

36. 20%. (This is generally considered an acceptable level for β in a study design.)

37. The sample size, precision of measurement, and the expected effect size.

38. Statistical power.

39. The null hypothesis **is not** rejected.

40. Meta-analysis.

41. Analysis of variance (ANOVA).

42. *t*-test.

43. Pearson correlation coefficient (*r*).

ETHICS

44. Autonomy, beneficence, nonmaleficence, and justice.

45. True.

46. Autonomy.

47. Disclosure, understanding, capacity, voluntariness.

48. Remember **WIPE** it away: **W**aiver, Legally **I**ncompetent, Therapeutic **P**rivilege, **E**mergency situation.

49. If the minor is married, self-supporting, or is in the military.

50. Remember **GIEMSA**: Decision is consistent with patient's values and **G**oals; Patient is **I**nformed (knows and understands); Patient **E**xpresses a choice; Decision is not a result of altered **M**ental status (eg, delirium, psychosis, intoxication), **M**ood disorder; Decision remains **S**table over time; Patient is ≥ 18 years of **A**ge or otherwise legally emancipated.

51. Oral advance directive.

52. If the patient was informed, the directive was specific, the patient made a choice, and the decision was repeated over time to multiple people.

53. Written advance directive (eg, living will).

54. Medical power of attorney.

55. True.

56. True.

57. A medical power of attorney.

58. The disclosure of information to family or friends should be guided by professional judgment of the patient's best interest. Recall that a patient may also waive their right to confidentiality.

59. Remember PASS the news along: Potential physical harm to others is serious and imminent; Alternative means to warn or protect those at risk is not possible; Self-harm is likely; Steps can be taken to prevent harm.

60. Public officials, who will then notify people at risk.

61. No. A physician may break confidentiality to report the abuse (or suspected abuse) of a child or an elderly person.

62. No. A physician may break confidentiality to report a suicidal or homicidal patient.

63. No. A physician may break confidentiality to report an impaired driver.

64. False. A patient's family cannot require the physician to withhold information from the patient.

65. Suggest that the patient speak directly to that physician about the concerns. If the problem is with a member of the office staff, inform the patient that you will speak to that person.

66. Attempt to identify the patient's reason for nonadherence and determine whether he or she is willing to change the behavior. Do not force the patient into adhering or refer the patient to another physician.

67. Many states require parental notification or consent for minors to have an abortion. Unless there are specific medical risks associated with pregnancy, a physician should not sway the patient/parent's decision for, or against, an elective abortion.

68. In most states, physicians should refuse to be involved in any form of physician-assisted death; however, the physician may prescribe medically appropriate analgesics even if they shorten the patient's life.

69. Attempt to understand why the patient wants the procedure, address the underlying concerns, and avoid performing unnecessary procedures. Do not refuse to see the patient or refer him/her to another physician.

70. Ask direct closed-ended questions and use a chaperone if necessary. It may be necessary to transition care to another physician. Romantic relationships with patients are never appropriate.

THE WELL PATIENT

71. Slower erection/ejaculation and a longer refractory period, but unchanged libido.

HEALTHCARE DELIVERY

72. HPV vaccination is an example of a primary disease prevention strategy. A pap smear is an example of secondary disease prevention. Chemotherapy is an example of tertiary disease prevention.

73. A-2, B-3, C-1, D-5, E-4

74. Medicare and Medicaid. Medicar**E** is for the **E**lderly, and Medicai**D** is for the **D**estitute.

75. Unintentional injury.

76. Mood disorders.

QUALITY AND SAFETY

77. A-3, B-1, C-2, D-4

78. Plan: define problem and solution

    Do: test new process

    Study: measure and analyze data

    Act: integrate new process into workflow.

79. Active.

80. Burnout; lack of concern; Fatigue; compromised intellectual function.

81. Retrospective.

Neurology and Special Senses

Questions

EMBRYOLOGY

1. What maternal disease is associated with anencephaly? *(p 491)* _____

2. Which neural tube defect results in a "smooth brain" that lacks sulci and gyri due to failure of neuronal migration? *(p 491)* _____

3. What are the sensory abnormalities in syringomyelia? *(p 492)* _____

   _____

4. Which pharyngeal arches form the posterior 1/3 of the tongue? *(p 493)* _____

ANATOMY AND PHYSIOLOGY

5. Match the cell type with its characteristic. *(pp 493-494)*

_____ A. Astrocytes	1. Form multinucleated giant cells in CNS
_____ B. Ependymal cells	2. Line the ventricles and central canal of spinal cord
_____ C. Microglia	3. Component of blood-brain barrier
_____ D. Neurons	4. Promote axonal regeneration
_____ E. Schwann cells	5. Permanent cells—do not divide in adulthood

6. _____ (Oligodendrocytes/Schwann cells) are injured in Guillain-Barré syndrome; _____ (Oligodendrocytes/Schwann cells) are injured in multiple sclerosis, progressive multifocal leukoencephalopathy (PML), and leukodystrophies. *(p 494)*

7. Match the disease with its alteration in the neurotransmitter. *(p 495)*

_____ A. Anxiety	1. Decrease in norepinephrine
_____ B. Depression	2. Increase in acetylcholine
_____ C. Huntington disease	3. Increase in dopamine
_____ D. Parkinson disease	4. Increase in norepinephrine

8. Which substances cross the blood-brain barrier quickly? Which substances cross it slowly? *(p 496)*

_____

_____

9. From which four areas does the brain's vomiting center, coordinated by nucleus tractus solitarius (NTS) in the medulla, receive information? *(p 496)* _____

_____

10. Match the area of the hypothalamus with its function. *(p 498)*

_____ A. Anterior nucleus	1. ADH and oxytocin synthesis
_____ B. Lateral nucleus	2. Circadian rhythm
_____ C. Paraventricular and supraoptic nuclei	3. Cooling
_____ D. Posterior nucleus	4. Heating
_____ E. Suprachiasmatic nucleus	5. Hunger
_____ F. Ventromedial nucleus	6. Satiety

11. Ascending sensory information from the body reaches the _____ (VPL/VPM) of the thalamus, and sensory information from the face reaches the _____ (VPL/VPM). *(p 498)*

12. Decreases in the activity of tuberoinfundibular pathway lead to increases in what secretory protein? *(p 499)* _____

13. The direct pathway utilizes the _____ receptor and _____ movement. The indirect pathway utilizes the_____ receptor and _____ movement. *(p 500)*

14. How does loss of dopamine in Parkinson disease affect the excitatory pathway? How does it affect the inhibitory pathway? *(p 500)* _____

_____

15. Cerebral perfusion is regulated by _____. *(p 501)*

16. What is the major vascular territory covered by the ACA? MCA? PCA? *(p 502*) _____

_____

_____

17. What structure secretes melatonin? *(p 504)* _____

_____

18. What structures pass through the superior orbital fissure? *(p 505)* _____

_____

19. Fill in the following chart describing the cranial nerves. *(pp 505-506)*

CN	Name	Function	Type (Sensory/ Motor/Both)	Location in Brainstem
I	Olfactory			
II	Optic			
III	Oculomotor			
IV	Trochlear			
V	Trigeminal			
VI	Abducens			
VII	Facial			
VIII	Vestibulocochlear			
IX	Glossopharyngeal			
X	Vagus			
XI	Accessory			
XII	Hypoglossal			

20. Which CNs mediate the pupillary response? *(p 507)* _____

21. If there is a lesion in CNs V_1 and VII, which reflexes are impaired? *(p 507)* _____

_____

22. Which CNs mediate the gag reflex? *(p 507)* _____

23. Which spinal nerves exit above the corresponding vertebra? Which spinal nerves exit below the corresponding vertebra? *(p 507)* _____

_____

24. Where is a lumbar puncture usually performed? *(p 507)* _____

25. Match these commonly tested reflexes to their main nerve roots. *(p 510)*

_____ A. Achilles	1. C5
_____ B. Biceps	2. C7
_____ C. Patellar	3. L4
_____ D. Triceps	4. S1

PATHOLOGY

26. Match the area of a brain lesion with its clinical effect(s). *(p 511)*

_____ A. Anterograde amnesia	1. Amygdala
_____ B. Contralateral hemiballismus	2. Basal ganglia
_____ C. Deficits in concentration, orientation, and judgment	3. Cerebellar hemisphere
_____ D. Eyes look toward side of hemiplegia	4. Cerebellar vermis
_____ E. Eyes look toward side of lesion	5. Frontal eye fields
_____ F. Intention tremor, limb ataxia, loss of balance	6. Frontal lobe
_____ G. Internuclear ophthalmoplegia	7. Hippocampus (bilateral)
_____ H. Klüver-Bucy syndrome	8. Mammillary bodies
_____ I. Parinaud syndrome	9. Medial longitudinal fasciculus
_____ J. Reduced levels of arousal and wakefulness	10. Reticular activating system
_____ K. Tremor at rest, chorea, or athetosis	11. PPRF
_____ L. Truncal ataxia and nystagmus	12. Subthalamic nucleus
_____ M. Wernicke-Korsakoff syndrome	13. Dorsal midbrain

27. Which three brain regions are most susceptible to hypoxia? *(p 512)* _____

_____

28. A 50-year-old woman presents to the emergency department with a headache and numbness on the right side. Her speech is difficult to understand, and her mouth droops when talking. Noncontrast CT of the head shows bright areas. Should tPA be administered? Why or why not? *(p 512)*

_____

_____

29. What are the causes of neonatal intraventricular hemorrhage? *(p 512)* _____

_____

30. On CT, an epidural hematoma _____ (does/does not) cross suture lines, but a subdural hematoma _____ (does/does not) cross suture lines. *(p 513)*

31. Lesions in PICA or AICA may result in vomiting, vertigo, nystagmus and ipsilateral Horner syndrome. The two can be distinguished because _____ lesions cause loss of pain and temperature sensation in the ipsilateral face and contralateral body, whereas _____ lesions cause paralysis of the face and pain in addition to temperature sensation loss in the ipsilateral face and contralateral body. _____ lesions cause decreased lacrimation, salivation, and taste, whereas _____ lesions cause decreased gag reflex, as well as dysphagia and hoarseness. *(p 514)*

32. A 44-year-old patient is unconscious after a serious car accident with visible head trauma. A scan of his brain shows multiple lesions involving the white matter tracts. What injury has the patient likely suffered, and what is his prognosis? *(p 515)* _____

_____

33. Fluent speech with impaired comprehension describes _____ (Broca/Wernicke) aphasia, whereas nonfluent speech with intact comprehension describes _____ (Broca/Wernicke) aphasia. *(p 516)*

34. Distinguish between fever and heat stroke. Include body temperature and recommended treatments for each in your response. *(p 517)* _____

_____

_____

_____

35. For each case, identify the type of seizure and its first-line treatment. *(pp 517, 532)*

A. A teenage boy suddenly stiffens, falls down, and experiences rhythmic jerking of his extremities lasting 1 minute. The patient loses consciousness and wakes up with confusion.

_____

B. A 7-year-old boy is having “behavioral problems” at school. He “spaces out” during class. EEG shows a 3-Hz spike-and-wave pattern. _____

C. A 45-year-old man who suffered a concussion from a car accident has episodes of jerky movements of his left arm that he cannot control. He remembers the incident itself, but had blacked out afterward. _____

_____

36. What are the main symptoms of a migraine? What mnemonic can you use to remember them? *(p 518)* _____

_____

_____

37. Define the following terms. *(p 519)*

A. Athetosis _____

B. Chorea _____

C. Dystonia _____

D. Myoclonus _____

38. Which nucleus is affected in Parkinson disease? In hemiballismus? In Huntington disease? *(p 519)*

_____

_____

39. What are the cardinal features of Parkinson disease? *(p 520)* _____

_____

_____

40. Match the type of dementia with its most defining histologic characteristic. *(pp 520-521)*

_____ A. Alzheimer disease	1. Atrophy of caudate and putamen
_____ B. Creutzfeldt-Jakob disease	2. Cortical and/or subcortical infarcts
_____ C. Frontotemporal dementia	3. Depigmentation of substantia nigra
_____ D. Huntington disease	4. Inclusions of hyperphosphorylated tau
_____ E. Parkinson disease	5. Neurofibrillary tangles
_____ F. Vascular dementia	6. Prions

41. What are risk factors for development of idiopathic intracranial hypertension (pseudotumor cerebri)? *(p 521)* _____

_____

42. What are the symptoms of normal pressure hydrocephalus? *(p 522)* _____

_____

43. Which disorder presents with increased IgG and myelin basic protein in the CSF? *(p 523)* _____

_____

44. "Locked-in syndrome" is a potential consequence of which demyelinating disorder? *(p 524)* _____

_____

45. For each case, identify the most likely neurocutaneous disorder. *(p 525)*

A. A 6-month-old presents with her first seizure. Wood's lamp examination shows several areas of hypopigmentation over her trunk and extremities. _____

B. A 6-month-old has a port-wine stain over his left eye and cheek, extending to the tip of his nose, with a sharp drop-off to normal-toned skin on the right side of his face. _____

_____

C. A 26-year-old has congestive heart failure, renal cell carcinoma, and pheochromocytoma. Imaging shows a cavernous hemangioma in the liver. _____

_____

D. A 6-month-old has multiple hyperpigmented brown macules scattered over the trunk and upper extremities. _____

46. For each case, identify the most likely brain tumor. *(pp 526-528)*

A. A 49-year-old man presents with a 2-month history of morning headaches. CT of the head shows a heterogeneous-appearing mass with irregular borders crossing the corpus callosum.
_____

B. A 40-year-old woman develops a small, well-circumscribed nodular-appearing lesion on her right frontal lobe. It appears to be attached to the skull. _____

C. A 4-year-old boy presents with a 1-month history of morning headaches, abnormal gait, and dysmetria. Imaging shows an appearance in the posterior fossa. _____

D. A 7-year-old girl presents with bitemporal hemianopia. Head CT shows calcifications.
_____

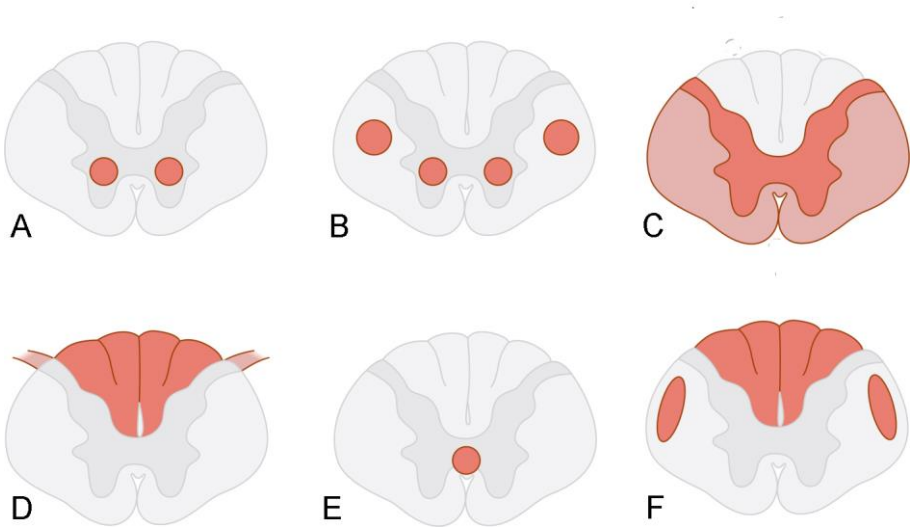
E. A 36-year-old woman presents with amenorrhea and "problems with peripheral vision." _____

_____

47. Using the following chart, compare and contrast the characteristics of upper and lower motor neuron lesions. *(p 529)*

Characteristic	UMN Lesion	LMN Lesion
Atrophy		
Babinski reflex		
Clasp knife spasticity		
Fasciculations		
Reflexes		
Spastic paresis		
Tone		
Weakness		

48. Identify the motor deficit and associated diseases for each lesion in the image below. *(p 530)*



A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

E. _____

_____

F. _____

_____

49. With a lesion in CN X, the uvula deviates _____ (toward/away from) the side of the lesion. *(p 532)*

50. With a lesion in CN XI, there is weakness turning the head _____ (toward/away from) the side of the lesion. *(p 532)*

51. With a lesion in CN XII, the tongue deviates _____ (toward/away from) the side of the lesion. *(p 532)*

OTOLOGY

52. In a patient with _____ (conductive/sensorineural) hearing loss, the Weber test localizes to the affected ear, whereas in a patient with _____ (conductive/sensorineural) hearing loss, the Weber test localizes to the unaffected ear. *(p 533)*

53. Presbycusis results in hearing loss of what types of sound frequencies? *(p 533*) _____

_____

54. A patient with central vertigo presents with _____ (nystagmus/tinnitus), while a patient with peripheral vertigo presents with _____ (nystagmus/tinnitus). *(p 534)*

OPHTHALMOLOGY

55. What is presbyopia? What might a patient need as a result? *(p 535)* _____

_____

_____

56. Where is the obstruction in open-angle glaucoma? Where is the obstruction in closed/narrow-angle glaucoma? Which one is painful? *(p 536)* _____

_____

_____

_____

57. When a patient is diagnosed with hypertensive retinopathy, under what conditions must the blood pressure be lowered immediately? *(p 537)* _____

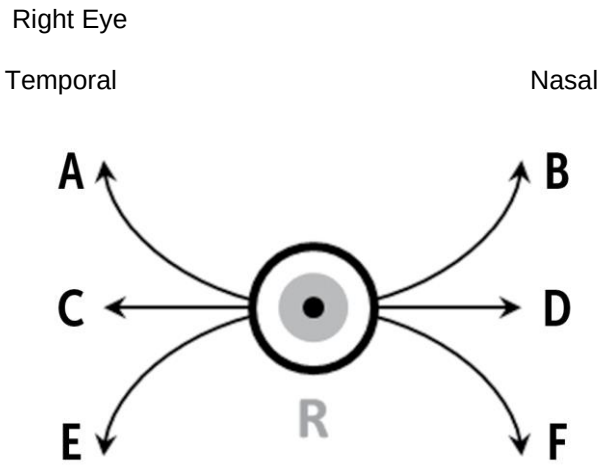
_____

58. Retinoblastoma, congenital cataract, and toxocariasis in children are all possible causes of what kind of medical sign? *(p 538)* _____

59. Horner syndrome is associated with which three symptoms? *(p 540)* _____

_____

60. Referring to the image, which cranial nerve and muscle are used with each movement? *(p 540)*



Line A: _____

Line B: _____

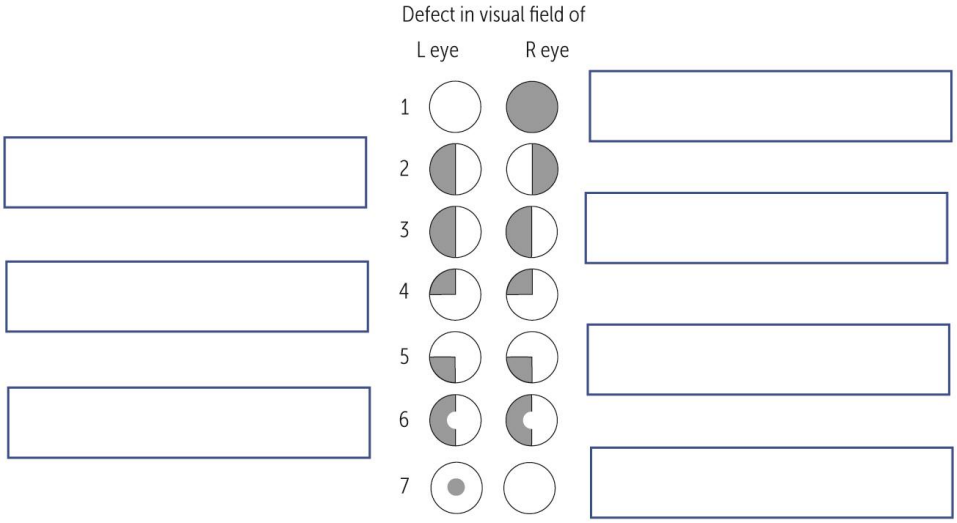
Line C: _____

Line D: _____

Line E: _____

Line F: _____

61. Identify the type of visual field defects in the image below. *(p 542)*



62. What structures pass through the cavernous sinus? *(p 542)* _____

_____

63. Horizontal diplopia develops in a 26-year-old woman with multiple sclerosis. Examination reveals she cannot adduct her left eye past midline and has a left-beating nystagmus in her right eye when looking to the right. However, her left eye can adduct during convergence. Where is the lesion most likely located? *(p 543)* _____

_____

_____

PHARMACOLOGY

64. Match the drug with its indication for use. *(pp 544, 546, 551-552)*

_____ A. Status epilepticus	1. Diazepam
_____ B. Absence seizures	2. Ethosuximide
_____ C. Chronic pain	3. Methadone
_____ D. Acute angle closure glaucoma	4. Phenobarbital
_____ E. Induction of anesthesia	5. Pilocarpine
_____ F. Insomnia	6. Thiopental
_____ G. Maintenance for heroin addicts	7. Tramadol
_____ H. Seizure prophylaxis in neonates	8. Zolpidem

65. Describe the mechanism of action for each drug commonly used to treat Parkinson disease. *(p 548)*

A. Benztropine _____

_____

B. Bromocriptine _____

C. L-DOPA /carbidopa _____

_____

D. Selegiline _____

66. In the chart below, identify the disease each neurodegenerative disease therapy treats and its mechanism of action. *(p 549)*

Disease	Agent	Mechanism
	Donepezil, rivastigmine, galantamine	
	Memantine	
	Riluzole	
	Tetrabenazine	

67. Anesthetics with low blood and lipid solubility have _____ (fast/slow) induction and recovery times, whereas anesthetics with high blood and lipid solubility have _____ (fast/slow) induction and high potency. *(p 549)*

68. What are the two clinical uses of dantrolene? *(p 551)* _____

_____

69. Which opioid analgesic drug is used for moderate to severe pain and may cause withdrawal symptoms if the patient is also taking a full opioid agonist? *(p 552)* _____

70. What is the clinical use for Tramadol? What are the adverse effects? *(p 552)* _____

_____

Answers

EMBRYOLOGY

1. Maternal diabetes and folate deficiency.
2. Lissencephaly.
3. “Cape-like” bilateral, symmetrical loss of pain and temperature sensation in upper extremities while fine touch sensation is preserved.
4. The 3rd and 4th pharyngeal arches.

ANATOMY AND PHYSIOLOGY

5. A-3, B-2, C-1, D-5, E-4.
6. Schwann cells; oligodendrocytes.
7. A-4, B-1, C-3, D-2.
8. Nonpolar/lipid-soluble substances cross rapidly (via diffusion); glucose and amino acids cross slowly (by carrier-mediated transport mechanisms).
9. The chemoreceptor trigger zone (CTZ, located within area postrema in 4th ventricle), GI tract (via vagus nerve), vestibular system, and CNS.
10. A-3, B-5, C-1, D-4, E-2, F-6
11. Body-VPL; face-VPM.
12. Prolactin.
13. D_1, facilitates, D_2, inhibits.
14. Loss of dopamine inhibits the excitatory pathway and disinhibits (or excites) the inhibitory pathway.
15. P_{CO2}

16. The ACA supplies the anteromedial surface of the brain, which covers the leg area of the motor and sensory cortices. The MCA supplies the lateral surface of the motor and sensory cortices, which cover the face and arm. The PCA supplies the posterior and inferior surfaces in the occipital lobe.

17. The pineal gland.

18. CN III, CN IV, CN V_1, CN VI, superior and inferior divisions of ophthalmic vein, and sympathetic fibers from the cavernous plexus.

19.

CN	Name	Function	Type (Sensory/ Motor/Both)	Location in Brainstem
I	Olfactory	Smell	Sensory	Olfactory bulb
II	Optic	Sight	Sensory	Midbrain
III	Oculomotor	Eye movements (SR, IR, MR, IO) Pupillary constriction Accommodation Eyelid opening	Motor	Midbrain
IV	Trochlear	Eye movement (SO)	Motor	Midbrain
V	Trigeminal	Facial sensation Mastication Somatosensation from anterior 2/3 of tongue Dampening of loud noises	Both	Pons
VI	Abducens	Eye movement (LR)	Motor	Pons
VII	Facial	Facial movement Taste from anterior 2/3 of tongue Lacrimation, salivation Eye closing Auditory volume modulation (stapedius)	Both	Pons
VIII	Vestibulocochlear	Hearing, balance	Sensory	Pons
IX	Glossopharyngeal	Taste from posterior 1/3 of tongue Swallowing, salivation Pharynx/larynx elevation Monitoring carotid body and sinus chemo- and baroreceptors	Both	Medulla

X	Vagus	Taste from supraglottic region Swallowing, soft palate elevation Midline uvula, talking Cough reflex Parasympathetics to thoracoabdominal viscera Monitoring aortic arch chemo- and baroreceptors	Both	Medulla
XI	Accessory	Head turning Shoulder shrugging	Motor	Spinal cord
XII	Hypoglossal	Tongue movement	Motor	Medulla

20. CNs II and III mediate the pupillary response.

21. The corneal and lacrimation reflexes are impaired if a lesion occurs in CNs V_1 and VII.

22. CNs IX and X mediate the gag reflex.

23. Nerves C1-C7 exit above the corresponding vertebrae; C8 spinal nerve exits below C7 and above T1; all the other nerves exit below the corresponding vertebrae.

24. In the L3-L4 or L4-L5 interspace.

25. A-4, B-1, C-3, D-2.

PATHOLOGY

26. A-7, B-12, C-6, D-11, E-5, F-3, G-9, H-1, I-13, J-10, K-2, L-4, M-8.

27. Hippocampus, neocortex, cerebellum (Purkinje cells), watershed areas.

28. This patient has had an ischemic stroke, and the bright areas on noncontrast CT indicate hemorrhage. Thus, tPA should not be administered.

29. Reduced glial fiber support and impaired autoregulation of blood pressure in premature infants.

30. Does not; does.

31. PICA; AICA; AICA; PICA.

32. The patient likely has suffered a diffuse axonal injury. He likely has a devastating neurologic injury, and may be in a coma or persistent vegetative state.

33. Wernicke; Broca.

34. Fever is cytokine activation during inflammation. Heat stroke is the body's inability to dissipate heat. A fever is usually less than 40 °C; someone experiencing heat stroke usually has a temperature above 40 °C. Fever may be treated with acetaminophen or ibuprofen for comfort and/or antibiotics if indicated. The treatment for heat stroke is rapid external cooling, rehydration and electrolyte correction.

35. A. Generalized tonic-clonic (grand mal) seizures. Treat with phenytoin, carbamazepine, or valproic acid.

    B. Absence (petit mal) seizures. Treat with ethosuximide.

    C. Simple partial seizures with secondary generalization. Virtually any antiepileptic drug can be used for treatment; the most common are phenytoin, carbamazepine, levetiracetam, and valproic acid.

36. The main symptoms of migraines are unilateral, pulsating pain with nausea, photophobia, or phonophobia. May have "aura." This pain is usually disruptive to everyday activity. Remember **POUND** (**P**ulsatile, **O**ne-day duration, **U**nilateral, **N**ausea, **D**isabling).

37. A. Athetosis: Slow, writhing movements, especially in the fingers.

    B. Chorea: Sudden, jerky, purposeless movements.

    C. Dystonia: Sustained, involuntary muscle contractions.

    D. Myoclonus: Sudden, brief, uncontrolled muscle contraction.

38. Parkinson: substantia nigra; hemiballismus: contralateral subthalamic nucleus; Huntington disease: basal ganglia.

39. Remember **TRAPSS** your body**: T**remor (pill-rolling tremor at rest), cogwheel **R**igidity, **A**kinesia (or bradykinesia), **P**ostural instability, **S**huffling gait, and **S**mall handwriting (micrographia).

40. A-5, B-6, C-4, D-1, E-3, F-2.

41. Risk factors for idiopathic intracranial hypertension (ICH) include **female** gender, **T**etracyclines, **O**besity, vitamin **A** excess, and **D**anazol (**female TOAD**).

42. Triad of gait apraxia, cognitive dysfunction, and urinary incontinence.

43. Multiple sclerosis.

44. Osmotic demyelination syndrome.

45. A. Tuberous sclerosis.

B. Sturge-Weber syndrome.

C. Cavernous hemangiomas can occur in isolation, but are associated with von Hippel-Lindau disease.

D. Neurofibromatosis type 1.

46. A. Glioblastoma multiforme.

B. Meningioma.

C. Medulloblastoma.

D. Craniopharyngioma.

E. Prolactinoma (pituitary adenoma).

47.

Characteristic	UMN Lesion	LMN Lesion
Atrophy	–	+
Babinski reflex	+	–
Clasp knife spasticity	+	–
Fasciculation	–	+
Reflexes	↑	↓
Spastic paresis	+	–
Tone	↑	↓
Weakness	+	+

48. A. Lower motor neuron symptoms only, symmetric weakness; attributable to congenital degeneration of anterior horns of spinal cord. Spinal muscular atrophy.

    B. Combination of upper and lower motor neuron degeneration with no sensory or bowel/bladder deficits. Amyotrophic lateral sclerosis (Lou Gehrig disease).

    C. Sparing of dorsal columns and Lissauer tract. UMN deficit below the lesion, LMN deficit at the level of the lesion, and loss of pain and temperature sensation below lesion. Complete occlusion of anterior spinal artery.

    D. Degeneration/demyelination of dorsal roots and columns; progressive sensory ataxia. Tabes dorsalis.

    E. Syrinx expands and damages anterior white commissure of spinothalamic tract; bilateral symmetric loss of pain and temperature sensation in cape-like distribution. Syringomyelia.

    F. Subacute combined degeneration (SCD)—demyelination of **s**pinocerebellar tracts, lateral **c**orticospinal tracts, and **d**orsal columns; ataxic gait, paresthesia, impaired position/vibration sense, UMN symptoms. Vitamin B_{12} deficiency.

49. The uvula deviates **away from** the side of the CN X lesion.

50. There is weakness turning the head **away from** (to contralateral side of) the CN XI lesion.

51. The tongue deviates **toward** the side of the CN XII lesion.

OTOLOGY

52. Conductive, sensorineural.

53. High-frequency sounds.

54. nystagmus, tinnitus.

OPHTHALMOLOGY

55. Presbyopia is an aging-related impairment of accommodation (focusing on near objects), primarily due to decreased lens elasticity, changes in lens curvature, and decreased strength of the ciliary muscle. Patients often need “reading glasses” (magnifiers).

56. Open-angle glaucoma is due to obstructed trabecular meshwork from WBCs (eg, uveitis), RBCs (eg, vitreous hemorrhage), retinal elements (eg, retinal detachment). Closed/narrow-angle glaucoma is due to obstruction of normal aqueous flow through the pupil, causing fluid buildup behind the iris, pushing the peripheral iris against the cornea and impeding flow through trabecular meshwork. Closed/narrow-angle glaucoma is painful.

57. The presence of papilledema would require blood pressure to be lowered immediately.

58. Leukocoria, which is a loss of the red reflex.

59. Ptosis, anhidrosis, miosis.

60. A – CN III – Superior rectus

B – CN III – Inferior oblique

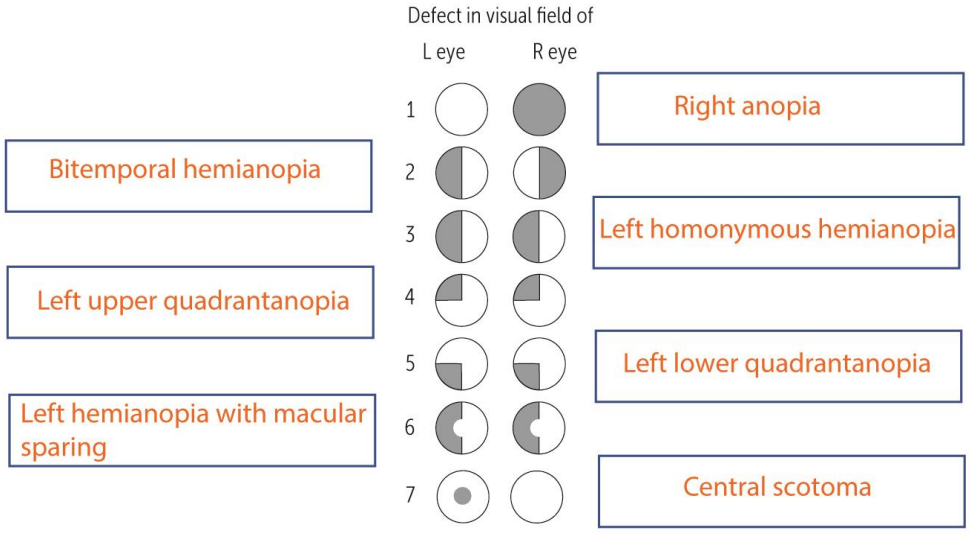
C – CN VI – Lateral rectus

D – CN III – Medial rectus

E – CN III – Inferior rectus

F – CN IV – Superior oblique

61.



62. CN III, CN IV, CN V_1, CN V_2, CN VI, postganglionic sympathetic pupillary fibers, cavernous portion of internal carotid artery.

63. The medial longitudinal fasciculus. Her left eye can adduct during convergence but not during right lateral gaze because the oculomotor nerve itself works perfectly, but the connection between the abducens nuclei and the oculomotor nuclei is impeded. The "message" to look right does not reach the left medial rectus, causing the right eye to beat leftward because of the disconjugate image.

PHARMACOLOGY

64. A-1, B-2, C-7, D-5, E-6, F-8, G-3, H-4.

65. A. Benztropine: curbs excess cholinergic activity; antimuscarinic; improves tremor and rigidity but has little effect on bradykinesia.

B. Bromocriptine: dopamine receptor agonist.

C. Levodopa (L-DOPA)/carbidopa: carbidopa blocks peripheral conversion of L-DOPA, to dopamine by inhibiting DOPA decarboxylase. Also reduces side effects of peripheral L-DOPA conversion into dopamine.

D. Selegiline, rasagiline: block conversion of dopamine into DOPAC by selectively inhibiting MAO-B.

66.

Disease	Agent	Mechanism
Alzheimer disease	Donepezil, rivastigmine, galantamine	AChE inhibitor
Alzheimer disease	Memantine	NMDA receptor antagonist; helps prevent excitotoxicity
Amyotrophic lateral sclerosis	Riluzole	Decreases neuron glutamate excitotoxicity
Huntington disease	Tetrabenazine	Inhibits vesicular monoamine transporter (VMAT); Decreases dopamine vesicle packaging and release

67. Fast; slow.

68. Malignant hyperthermia and neuroleptic malignant syndrome.

69. Pentazocine.

70. Tramadol is used to treat chronic pain. It can decrease seizure threshold and may cause serotonin syndrome.

Pharmacology

Questions

PHARMACOKINETICS AND PHARMACODYNAMICS

1. Competitive inhibitors _____ (do/do not) resemble the substrate, but noncompetitive inhibitors _____ (do/do not) resemble the substrate. *(p 230)*

2. K_m is inversely related to the _____ of the enzyme for its substrate. *(p 230)*

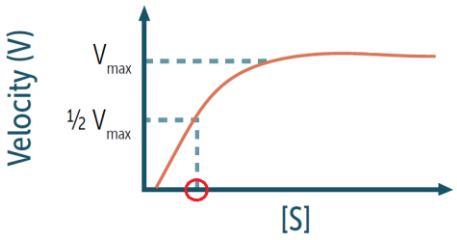
3. True or False: In enzyme kinetics, the lower the K_m, the higher the affinity. *(p 230)* _____

4. V_{max} is directly proportional to the _____ _____. *(p 230)*

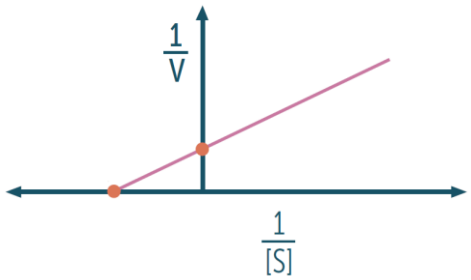
5. A graph of substrate concentration on the x-axis and velocity of the reaction on the y-axis has _____ (increasing/decreasing) velocity as substrate is increased, although it will plateau when the enzyme is saturated. *(p 230)*

6. When velocity is equal to one-half of its maximum (V_{max}), the corresponding concentration of substrate is equal to what value (as indicated by the circle on the graph below)? *(p 230)* _____

_____



7. Use the Lineweaver-Burk plot below to answer the following questions. *(p 230)*



A. What pharmacodynamic term describes the x-intercept of the line? _____

B. What pharmacodynamic term describes the y-intercept? _____

C. If the y-intercept increases, how is the maximum reaction rate affected? _____

D. If the x-intercept moves to the right (increases), how is the K_m affected? _____

8. In enzyme kinetics, a reversible competitive inhibitor _____ (can/cannot) be overcome by increasing the concentration of substrate; a noncompetitive inhibitor _____ (can/cannot) be overcome by increasing the concentration of substrate. *(p 230)*

9. Reversible competitive inhibitors _____ (increase/decrease/do not change) the V_{max} of the reaction, whereas noncompetitive inhibitors _____ (increase/decrease/do not change) the V_{max} of the reaction. *(p 230)*

10. Reversible competitive inhibitors _____ (increase/decrease/do not change) the K_m of the reaction, whereas noncompetitive inhibitors _____ (increase/decrease/do not change) the K_m of the reaction. *(p 230)*

11. What is the formula for calculating a drug's volume of distribution? *(p 231)* _____

_____

12. Drugs with a low volume of distribution are found in the _____ (intravascular space/tissue/extracellular fluid). Drugs with a high volume of distribution are most likely found in the _____ (blood/tissue/extracellular fluid). *(p 231)*

13. What is the formula for calculating a drug's clearance? *(p 231)* _____

_____

14. What is the definition of the half-life of a drug? *(p 231)* _____

15. For a drug that is infused at a constant rate, how many half-lives must pass before the drug reaches approximately 90% of steady-state concentration? *(p 231)* _____

16. Given the volume of distribution and clearance of a drug, how is the drug's half-life calculated? *(p 231)* _____

17. After 1 half-life, given constant intravenous infusion of a drug, how close to steady state is the drug's concentration? How close is it after 3 half-lives? *(p 231)* _____

18. What is the formula for calculating a drug's loading dose? *(p 231)* _____

_____

19. What is the formula for calculating the maintenance dose of a drug administered intravenously? *(p 231)* _____

20. How do the loading and maintenance doses of drugs differ for patients with severe renal or liver disease? *(p 231)* _____

21. What is the bioavailability (%) of a drug if it is administered intravenously? *(p 231)* _____

22. In zero-order elimination of drugs from the body, what is the relationship between the rate of elimination and the drug concentration? *(p 232)* _____

_____

23. Name three drugs that exhibit zero-order elimination. *(p 232)* _____

_____

24. In first-order drug elimination, what is the relationship between the rate of elimination and the drug concentration? *(p 232)* _____

_____

25. A 24-year-old man attempts suicide by consuming the contents of a small bottle of aspirin. Three hours later he is brought to the emergency room, where he is administered intravenous saline with sodium bicarbonate. By what mechanism does this help him? *(p 233)* _____

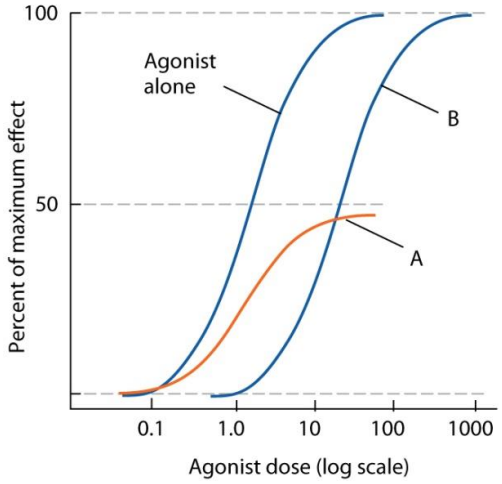
_____

26. A drug that requires a very low dose to achieve its desired effect is _____ (effective/potent). *(p 233)*

27. What is the formula for therapeutic index? Does a safe drug have a low or a high therapeutic index? *(p 234)* _____

_____

28. The following graph shows the effects of two types of antagonists on an agonist. What type of antagonist (competitive/noncompetitive) is represented by curve A? _____ By curve B? _____ *(p 234)*



29. The addition of a noncompetitive antagonist _____ (increases/decreases/does not change) the efficacy of the agonist. *(p 234)*

30. How does the efficacy of a partial agonist relate to the efficacy of a full agonist of the same receptor? *(p 234)* _____

31. How does the potency of a partial agonist relate to the potency of a full agonist of the same receptor? *(p 234)* _____

_____

AUTONOMIC DRUGS

32. Urinary retention is mediated by _____ (SNS/PNS) while urinary voiding is mediated by _____ (SNS/PNS). *(p 237)*

33. Identify the G-protein class for each receptor. (Numbers may be used more than once.) *(p 238)*

_____ A. α_1
_____ B. α_2
_____ C. β_1
_____ D. β_2
_____ E. D_1
_____ F. D_2
_____ G. H_1
_____ H. H_2
_____ I. M_1
_____ J. M_2
_____ K. M_3
_____ L. V_1
_____ M. V_2

1. G_i
2. G_q
3. G_s

34. What are the major effects of α_1-receptor activation? *(p 238)* _____

_____

35. What are the major functions of α_2-receptor activation? *(p 238)* _____

_____

36. What is the effect of clonidine on sympathetic outflow? On which receptor does it act? *(pp 238, 243)*

_____

_____

37. What are the major functions of β_1-receptor activation? *(p 238)* _____

_____

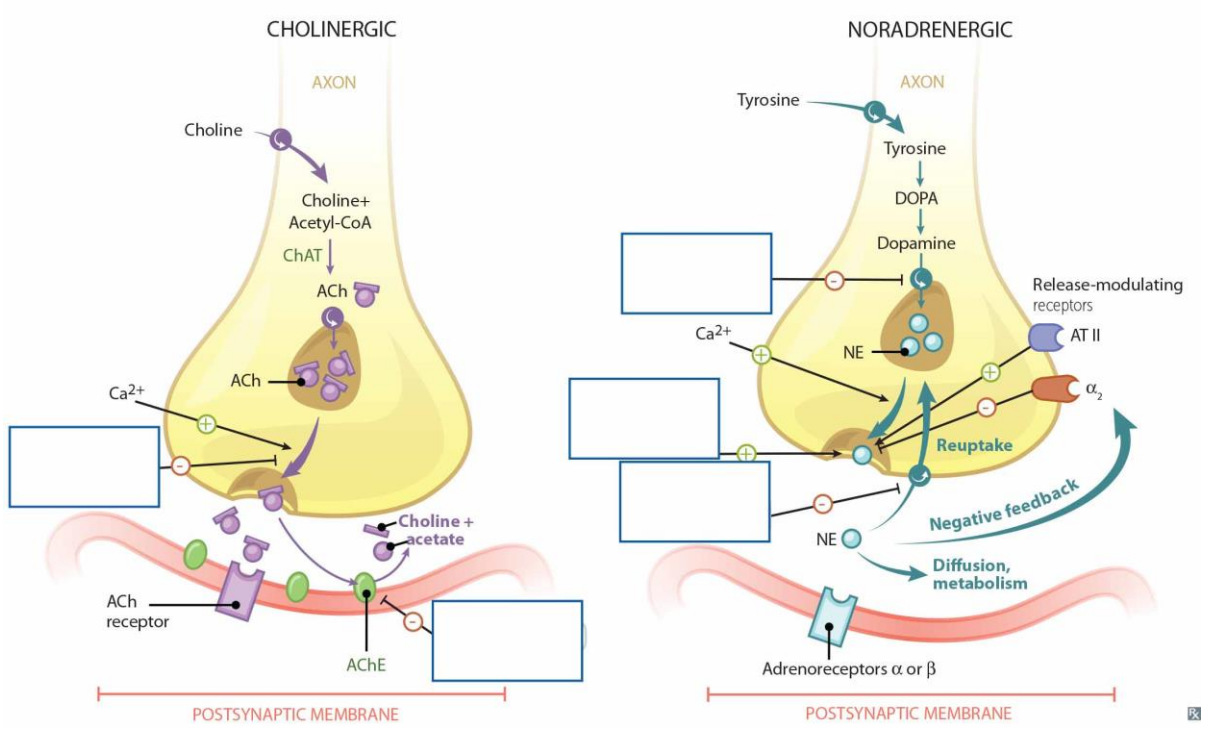
38. What is the major effect of β_2-receptor activation on the body's vasculature? What is the effect on the respiratory system? *(p 238)* _____

39. How does β_2-receptor activation affect insulin release? *(p 238)* _____

_____

40. Identify which autonomic drugs (in the box) work at each site of action in the images below. *(p 239)*

- AChE inhibitors
- Amphetamine, ephedrine
- Botulinum toxin
- Cocaine, TCAs, amphetamine
- Reserpine



41. What are some potential side effects for a patient taking a cholinomimetic agent? *(p 240)* _____

_____

42. Which pharmacologic agent is used to treat atropine overdose? *(p 240)* _____

43. What is a methacholine challenge test? *(p 240)* _____

_____

_____

44. A farmer presents with diarrhea, abdominal pain, wheezing, pinpoint pupils, copious tears, and salivation. List the drugs that you would administer to treat his condition. *(pp 240, 248)* _____

_____

45. Why is pyridostigmine used to treat myasthenia gravis? *(p 240)* _____

_____

46. Name seven indirect agonists (anticholinesterases). *(p 240*) _____

_____

47. A patient recently began taking haloperidol to treat schizophrenia, but visits his physician because of new-onset Parkinson-like motor symptoms. What drug could be used to treat these symptoms? *(p 241*) _____

48. What are the two effects of atropine on the eye? *(p 241)* _____

49. True or False: Diarrhea is a sign of atropine toxicity. *(p 241)* _____

50. Isoproterenol is an agonist for which receptors? *(p 242)* _____

51. Dopamine _____ (is/is not) inotropic and _____ (is/is not) chronotropic, whereas dobutamine _____ is (more/less) inotropic and _____ (more/less) chronotropic. *(p 242)*

52. Epinephrine affects which two adrenergic receptors? *(p 242)* _____

_____

53. What are the clinical applications of epinephrine? *(p 242)* _____

_____

54. What are the clinical applications of phenylephrine? *(p 242)* _____

_____

55. What is the clinical application for albuterol? *(p 242)* _____

_____

56. What effect does isoproterenol have on blood pressure and heart rate? *(pp 242-243)* _____

_____

57. What is the clinical application and mechanism of action of phentolamine? *(p 244)* _____

_____

58. What is the net effect of epinephrine on blood pressure before and after nonselective α-blockade? Why? *(p 244)* _____

_____

59. A 63-year-old man is referred to long-term care after his first myocardial infarction. Is a β-blocker suggested or contraindicated for this patient? Why? *(p 245)* _____

_____

60. How do β-blockers work in the setting of angina pectoris? *(p 245)* _____

_____

61. What is the receptor selectivity of atenolol? Propranolol? *(p 245)* _____

_____

62. Name two nonselective α- and β-antagonists. *(p 245)* _____

63. What are the clinical uses for nonspecific PDE inhibitors and PDE-5 inhibitors? *(p 246)*

_____

64. What is the mechanism of action for PDE-4 inhibitors? For platelet inhibitors? *(p 246)* _____

_____

65. What is the mechanism of action of ciguatoxin? *(p 247)* _____

_____

TOXICITIES AND SIDE EFFECTS

66. Match the specific antidote(s) with each toxicity. *(p 248)*

_____ A. Acetaminophen	1. 100% O_2, hyperbaric O_2
_____ B. Antimuscarinics, anticholinergic agents	2. Digoxin-sp. antibody fragments
_____ C. β-Blockers	3. Atropine > pralidoxime
_____ D. Benzodiazepines	4. Deferoxamine, deferasirox, deferiprone
_____ E. Carbon monoxide	5. Dimercaprol, succimer
_____ F. Copper	6. EDTA, dimercaprol, succimer, penicillamine
_____ G. Cyanide	7. PCC/FFP (immediate), vitamin K (delayed)
_____ H. Digitalis (digoxin)	8. Fomepizole > ethanol, dialysis
_____ I. Heparin	9. Flumazenil
_____ J. Iron	10. Glucagon, atropine, saline
_____ K. Lead	11. Methylene blue, vitamin C (reducing agent)
_____ L. Mercury, arsenic	12. *N*-acetylcysteine (replenishes glutathione)
_____ M. Methanol, ethylene glycol (antifreeze)	13. $NaHCO_3$ (stabilizes cardiac cell membrane)
_____ N. Methemoglobin	14. $NaHCO_3$ (alkalinize urine), dialysis
_____ O. Opioids	15. Naloxone
_____ P. Organophosphates, AChE inhibitors	16. Hydroxocobalamin, nitrites + sodium thiosulfate,
_____ Q. Salicylates	17. Penicillamine, trientine
_____ R. TCAs	18. Physostigmine, control hyperthermia
_____ S. Warfarin	19. Protamine sulfate

67. List several medications that can cause agranulocytosis. *(p 250)* _____

_____

68. OCPs can cause what kind of complications? *(p 250)* _____

69. Which medications can cause hemolysis in patients with G6PD deficiency? *(p 250)* _____

_____

70. Which medications can cause megaloblastic anemia? *(p 250)* _____

_____

71. Which medications can cause drug-induced lupus? *(p 250)* _____

_____

72. Which medications can cause photosensitivity? *(p 250)* _____

_____

73. Which medications can induce seizures? *(p 251)* _____

_____

74. Which medications can cause a Parkinson-like syndrome? *(p 251)* _____

_____

75. Which medications can cause pulmonary fibrosis? *(p 251)* _____

_____

76. Which medications can cause a disulfiram-like reaction? *(p 251)* _____

_____

77. Which medications can cause nephrotoxicity and ototoxicity? *(p 251)* _____

_____

78. Amphetamines, cocaine, and LSD (increase/decrease) _____ pupil size while heroin and opioids (increase/decrease) _____ pupil size. *(p 252)*

79. In the chart below, indicate whether the substances are P-450 inducers or inhibitors. *(p 252)*

Substance	P-450 Inducer	P-450 Inhibitor
Alcohol use, acute		
Alcohol use, chronic		
Carbamazepine		
Cimetidine		
Griseofulvin		
Isoniazid		
Ketoconazole		
Phenobarbital		
Phenytoin		
Rifampin		
St. John's wort		
Sulfonamides		

80. Which drugs must be avoided in patients with sulfa allergy? *(p 252)* _____

_____

MISCELLANEOUS

81. Match the drug name suffix with its category or usage. (Numbers may be used more than once.) *(pp 253-254)*

_____ A.	-afil	1.	5-$HT_{1B/1D}$ agonist
_____ B.	-gliflozin	2.	α_1-blocker
_____ C.	-azine	3.	ACE inhibitor
_____ D.	-conazole	4.	Angiotensin-II receptor blocker
_____ E.	-barbital	5.	β-blocker
_____ F.	-prazole	6.	Barbiturate
_____ G.	-chol	7.	Benzodiazepine
_____ H.	-cillin	8.	AChE inhibitor
_____ I.	-cycline	9.	Cholinergic agonist
_____ J.	-gliptin	10.	Viral DNA polymerase inhibitor
_____ K.	-ipramine	11.	DPP-4 inhibitors
_____ L.	--stigmine	12.	Ergosterol synthesis inhibitor
_____ M.	-navir	13.	H_2-antagonist
_____ N.	-olol	14.	SGLT-2 inhibitor
_____ O.	-ovir	15.	Proton pump inhibitor
_____ P.	-pril	16.	PDE-5 inhibitor
_____ Q.	-sartan	17.	Macrolide antibiotic
_____ R.	-tidine	18.	Protease inhibitor
_____ S.	-triptan	19.	Protein synthesis inhibitor
_____ T.	-triptyline	20.	TCA
_____ U.	-thromycin	21.	Transpeptidase inhibitor
_____ V.	-zepam	22.	Typical antipsychotic
_____ W.	-zolam		
_____ X.	-zosin		

82. Match the biologic agent suffix with its category or usage. *(p 254)*

_____ A.	-cept	1.	Chimeric human-mouse monoclonal Antibody
_____ B.	-ciclib	2.	Cyclin-dependent kinase inhibitor
_____ C.	-kinra	3.	Human monoclonal Antibody
_____ D.	-leukin	4.	Humanized mouse monoclonal Antibody
_____ E.	-umab	5.	IL-2 agonist/analog
_____ F.	-tinib	6.	Interleukin receptor antagonist
_____ G.	-ximab	7.	Proteasome inhibitor
_____ H.	-zomib	8.	TNF-α antagonist
_____ I.	-zumab	9.	Tyrosine kinase inhibitor

Answers

PHARMACOKINETICS AND PHARMACODYNAMICS

1. Do; do not.
2. Affinity.
3. True.
4. Enzyme concentration.
5. Increasing.
6. K_m.
7. A = 1/-K_m; B = 1/V_{max}; C = it decreases; D = K_m increases (affinity decreases).
8. Can; cannot. This is because competitive inhibitors bind the active site of the enzyme, competing with the substrate, whereas noncompetitive inhibitors bind elsewhere on the enzyme and so are not affected by substrate concentration.
9. Do not change; decrease.
10. Increase; do not change.
11. Volume of distribution (V_d) = amount of drug in the body / plasma drug concentration.
12. Intravascular space (These drugs do not distribute outside the plasma.); blood, tissue, and extracellular fluid. (These drugs distribute throughout the body.)
13. Clearance (CL) = rate of elimination of drug / plasma drug concentration = V_d x K_e (elimination constant).
14. The time required to change the amount of drug in the body by one-half during elimination.
15. 3.3 half-lives.
16. Half-life ($t_{½}$) = 0.7 × V_d (volume of distribution) / CL (clearance).
17. 50% of steady-state concentration; 87.5% of steady-state concentration.

18. Loading dose = C_p x V_d / F; Cp = target plasma concentration at steady rate, V_d = volume of distribution, and F = bioavailability.

19. Maintenance dose = C_p x CL x τ / F; C_p = target plasma concentration at steady rate, CL = clearance, τ = dosage interval, and F = bioavailability.

20. For both diseases, the loading dose usually does not change, but the maintenance dose decreases.

21. 100%.

22. The rate of elimination is constant, or linear, regardless of the drug concentration.

23. Phenytoin, ethanol, and aspirin (at high or toxic concentrations).

24. The rate of first-order elimination is directly proportional to the drug concentration. A constant fraction of drug (rather than a constant amount) is eliminated per unit of time.

25. Sodium bicarbonate alkalinizes the lumen of the nephrons, which traps acetylsalicylic acid within the lumen because it is a weak acid and is ionized in a basic environment.

26. Potent.

27. Therapeutic index = TD_{50} / ED_{50} = median toxic dose / median effective dose. A drug with a high therapeutic index is safer than a drug with a low therapeutic index.

28. A = noncompetitive antagonist; B = competitive antagonist.

29. Decreases.

30. A partial agonist has lower maximal efficacy than a full agonist.

31. A partial agonist may be more or less potent than or as potent as a full agonist.

AUTONOMIC DRUGS

32. Urinary retention is mediated by **SNS** while urinary voiding is mediated by **PNS**.

33. A-2, B-1, C-3, D-3, E-3, F-1, G-2, H-3, I-2, J-1, K-2, L-2, M-3.

34. α_1-receptor activation increases vascular smooth muscle contraction, pupillary dilator muscle contraction (mydriasis), and intestinal and bladder sphincter muscle contraction.

35. α_2-receptor activation decreases sympathetic (adrenergic) outflow, lipolysis, aqueous humor production, and insulin release, while increasing platelet aggregation.

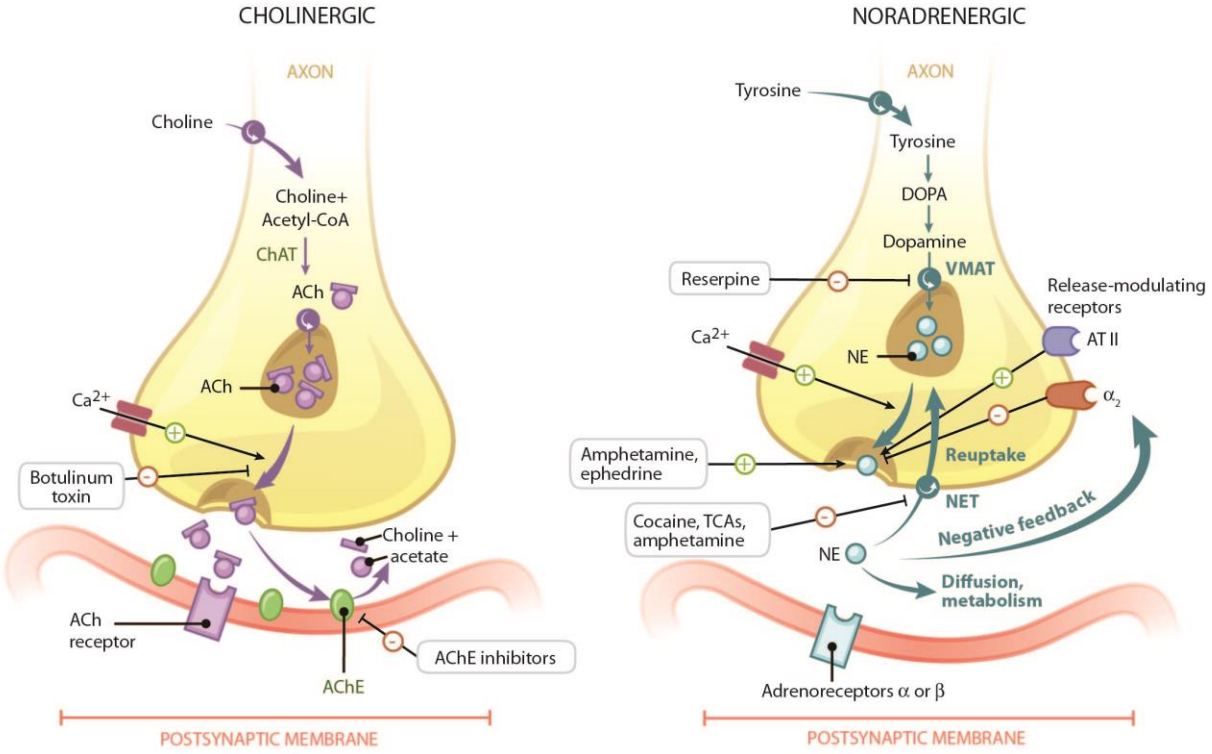
36. Clonidine is an α_2-agonist that decreases sympathetic (adrenergic) outflow. (Remember: the α_2-receptor is responsible for negative feedback.)

37. β_1-receptor activation increases the following: heart rate and contractility, renin release from the kidneys, and lipolysis of adipose tissue.

38. Vasodilation; bronchodilation.

39. β_2-Receptor activation increases insulin release.

40.



41. Exacerbation of COPD, asthma, and peptic ulcers.

42. Physostigmine. It freely crosses the blood-brain barrier and reverses the effects on the CNS.

43. A test in which methacholine is inhaled to stimulate muscarinic receptors and induce bronchoconstriction. The test is used to diagnose asthma.

44. This patient has the classic signs of organophosphate (anticholinesterase) poisoning, which is treated with atropine and pralidoxime.

45. Pyridostigmine increases the amount of acetylcholine in the neuromuscular synapse, thereby increasing muscle strength.

46. Neostigmine, pyridostigmine, physostigmine, donepezil, rivastigmine, galantamine, and edrophonium.

47. Benztropine or trihexyphenidyl.

48. Pupil dilation (mydriasis) and cycloplegia.

49. False. (Constipation is a sign of atropine toxicity.)

50. β_1 and β_2 (equally).

51. Dopamine **is** inotropic and **is** chronotropic; dobutamine is **more** inotropic and **less** chronotropic.

52. β and α; β > α normally, but alpha effects predominate at high doses of epinephrine.

53. Epinephrine treats anaphylaxis, open-angle glaucoma, and asthma.

54. Phenylephrine treats nasal congestion (rhinitis), hypotension (vasoconstrictor), dilates pupils, and counters ischemic priapism.

55. Albuterol treats acute asthma and COPD.

56. Isoproterenol increases blood pressure and heart rate.

57. Phentolamine is a reversible α-blocker given to patients on MAO inhibitors who eat tyramine-containing foods and for severe cocaine-induced hypertension (2nd line).

58. Before α-blockade, epinephrine increases blood pressure. After α-blockade, it decreases blood pressure. This is because epinephrine also activates β_2, which lowers blood pressure and is not blocked.

59. Suggested. After myocardial infarction, patients should receive β-blockers to decrease risk of mortality (long-term).

60. They decrease heart rate and contractility, thereby reducing myocardial oxygen consumption.

61. Atenolol is β_1 selective; propranolol is nonselective ($\beta_1 = \beta_2$).

62. Carvedilol and labetalol.

63. Nonspecific PDE inhibitors are used to treat COPD and asthma (rarely) PDE-5 inhibitors are used to treat erectile dysfunction, pulmonary hypertension, and BPH.

64. PDE-4 inhibitors increase cAMP in neutrophils, granulocytes, and bronchial epithelium. Platelet inhibitors increase cAMP in platelets and inhibit platelet aggregation.

65. Ciguatoxin opens sodium channels which causes depolarization.

TOXICITIES AND SIDE EFFECTS

66. A-12, B-18, C-10, D-9, E-1, F-17, G-16, H-2, I-19, J-4, K-6, L-5, M-8, N-11, O-15, P-3, Q-14, R-13, S-7.

67. Ganciclovir, clozapine, carbamazepine, colchicine, dapsone, methimazole, and propylthiouracil.

68. Thrombotic complications.

69. Isoniazid, sulfonamides, primaquine, aspirin, ibuprofen, dapsone, and nitrofurantoin.

70. Hydroxyurea, phenytoin, methotrexate, and sulfa drugs.

71. Methyldopa, minocycline, sulfa drugs, hydralazine, Isoniazid, procainamide, phenytoin, and etanercept.

72. Sulfonamides, amiodarone, 5-FU, and tetracyclines.

73. Isoniazid, bupropion, imipenem/cilastatin, tramadol, and enflurane.

74. Antipsychotics, metoclopramide, and reserpine.

75. Bleomycin, amiodarone, methotrexate, nitrofurantoin, carmustine, and busulfan.

76. Certain cephalosporins, griseofulvin, first-generation sulfonylureas, metronidazole, and procarbazine.

77. Aminoglycosides, cisplatin, loop diuretics, amphotericin B, and vancomycin.

78. Increase; decrease.

79.

Substance	P-450 Inducer	P-450 Inhibitor
Alcohol use, acute		√
Alcohol use, chronic	√	
Carbamazepine	√	
Cimetidine		√
Griseofulvin	√	
Isoniazid		√
Ketoconazole		√
Phenobarbital	√	
Phenytoin	√	
Rifampin	√	
St. John's wort	√	
Sulfonamides		√

80. **S**ulfonamide antibiotics, **s**ulfasalazine, **p**robenecid, **f**urosemide, **a**cetazolamide, **c**elecoxib, **t**hiazides, and **s**ulfonylureas. (Remember: **S**cary **S**ulfa **P**harm **FACTS**.)

MISCELLANEOUS

81. A-16, B-14, C-22, D-12, E-6, F-15, G-9, H-21, I-19, J-11, K-20, L-8, M-18, N-5, O-10, P-3, Q-4, R-13, S-1, T-20, U-17, V-7, W-7, X-2.

82. A-8, B-2, C-6, D-5, E-3, F-9, G-1, H-7, I-4.

Psychiatry

Questions

PSYCHOLOGY

1. Match each term with its definition. *(p 554)*

_____ A. Repeated application of aversive stimulus or removal of desired reward to extinguish unwanted behavior

_____ B. Patient projects feelings about someone onto physician

_____ C. Physician projects feelings about someone onto patient

_____ D. Target behavior is followed by desired reward

_____ E. Response is elicited by a learned stimulus presented in conjunction with an unconditioned stimulus

1. Classical conditioning
2. Countertransference
3. Positive reinforcement
4. Punishment
5. Transference

2. In the chart below, identify the defense mechanism and label it as mature or immature. *(pp 554-555)*

Behavior	Defense Mechanism	Mature or Immature
A football player jokes about playing the defending state champions the following week.		
A survivor of an earthquake describes the event and her town's destruction with no emotional response.		
A man wants to cheat on his wife, but instead writes a romance novel that becomes a best-seller.		
Since childhood, a man has been getting away with stomping his feet when upset because nobody has corrected him.		
A child throws a temper tantrum when he cannot have candy.		
A former heroin addict decides to volunteer at an anti–drug-abuse program at a local school		
A man who is angry at his wife responds defensively to her questions, assuming she must also be angry with him		
A man who is angry at his wife yells at his son.		
"How are you taking the diagnosis?" "You mean the cancer? I've got 3 mouths to feed, a living will to establish, medical bills to pay… so I'm not thinking about cancer right now…"		

PATHOLOGY

3. Name three common causes of a loss of orientation. *(p 557)* _____

_____

4. What is the ultimate treatment for a state of delirium? *(p 558)* _____

_____

5. Fill in the chart below, comparing the following disorders. *(pp 560-561)*

Disorder	Criteria	No. of Criteria Needed to Diagnose	Criteria Must be Present How Long?
Major depressive disorder			
Manic episode			
Schizophrenia			

6. What is the recommended treatment for trichotillomania? *(p 563)* _____

_____

7. In one word, patients with cluster A personality disorder can be described as _____. Those with cluster B personality disorder can be described as _____. Those with cluster C personality disorder can be described as _____. *(p 565)*

8. Identify the type of personality disorder. (Numbers may be used more than once.) *(pp 565-566)*

_____ A. Antisocial personality disorder
_____ B. Avoidant personality disorder
_____ C. Borderline personality disorder
_____ D. Dependent personality disorder
_____ E. Histrionic personality disorder
_____ F. Narcissistic personality disorder
_____ G. Obsessive-compulsive disorder
_____ H. Paranoid personality disorder
_____ I. Schizoid personality disorder
_____ J. Schizotypal personality disorder

1. Cluster A
2. Cluster B
3. Cluster C

9. _____ is a common defense mechanism used by patients who have borderline personality disorder. They also frequently show signs of _____ on their hands and arms. *(p 565)*

10. What is the main difference between anorexic and bulimic patients? What treatments are useful? *(p 567)* _____

_____

11. Which criteria must be present to diagnose a patient with enuresis? *(p 568)* _____

_____

12. Name the six stages to overcoming an addiction. *(p 568)* _____

_____

_____

_____

13. Match the psychiatric emergency with its associated fact. *(p 569)*

_____ A. Acute dystonia	1. Alcohol withdrawal
_____ B. Delirium tremens	2. Autonomic instability
_____ C. Hypertensive crisis	3. Convulsions, coma, cardiotoxicity
_____ D. Lithium toxicity	4. Myoglobinuria
_____ E. Neuroleptic malignant syndrome	5. Nephrogenic diabetes insipidus
_____ F. Serotonin syndrome	6. Sudden onset of muscle spasm and stiffness
_____ G. Tricyclic antidepressant toxicity	7. Tyramine-rich foods with MAOIs

14. What is the treatment of choice for delirium tremens? *(p 569)* _____

_____

15. A patient presents to the emergency department with confusion and high fever. He has an extensive psychiatric history, but his specific diagnosis and prescription history are not immediately available. Which symptoms are important in determining whether the patient is suffering from serotonin syndrome or neuroleptic malignant syndrome? *(p 569)* _____

_____

_____

_____

16. Cocaine intoxication is characterized by _____ (constricted/dilated) pupils; opioid intoxication is characterized by _____ (constricted/dilated) pupils. *(pp 570-571)*

PHARMACOLOGY

17. Match the medication with its most common usage. *(pp 569, 571-576)*

_____ A. Buspirone	1. ADHD
_____ B. Clozapine	2. Bipolar disorder
_____ C. Cyproheptadine	3. Depression, atypical
_____ D. Dantrolene	4. Depression with insomnia
_____ E. Haloperidol	5. Generalized anxiety disorder
_____ F. Lithium	6. Heroin detoxification
_____ G. Methadone	7. Insomnia
_____ H. Methylphenidate	8. Neuroleptic malignant syndrome
_____ I. Mirtazapine	9. Schizophrenia (positive symptoms)
_____ J. Phenelzine	10. Schizophrenia (positive and negative symptoms)
_____ K. Trazodone	11. Serotonin syndrome
_____ L. Varenicline	12. Smoking cessation
_____ M. Vitamin B_1	13. Wernicke-Korsakoff syndrome

18. Match the type of therapy with its description. *(p 572)*

_____ A. Dialectical behavioral	1. Teaches patients to identify and change maladaptive behaviors or reactions to stimuli
_____ B. Behavioral	2. Teaches patients to recognize thought distortions and develop constructive coping skills
_____ C. Interpersonal	3. Uses empathy to help in hardship to maintain optimism or hope
_____ D. Cognitive behavioral	4. Focused on improving communication skills
_____ E. Supportive	5. Designed for use in borderline personality disorder

19. List three treatment options for panic disorder. *(p 572)* _____

_____

20. List three treatment options for obsessive-compulsive disorder. *(p 572)* _____

_____

21. List five treatment options for bipolar disorder. *(p 572)* _____

_____

22. List three treatment options for generalized anxiety disorder. Which would you give to a truck driver and why? *(pp 572, 574)* _____

_____

23. Which class of antipsychotic is most likely to present with feelings of restlessness and bradykinesia? *(p 573)* _____

24. What are the four extrapyramidal symptoms of typical antipsychotics, and at what time points do they normally occur? *(p 573)* _____

_____

_____

25. Both olanzapine and clozapine are known for which adverse effect (more than other antipsychotics)? What is the most feared side effect of clozapine use? *(p 573)* _____

_____

_____

26. What are the classic adverse effects of lithium? *(p 574)* _____

_____

_____

27. Which drugs block reuptake of both serotonin and norepinephrine? Which agent blocks the reuptake of serotonin exclusively? *(pp 574-575)* _____

_____

28. Why is nortriptyline a better choice than amitriptyline for an elderly patient with depression? *(p 575)* _____

_____

29. Which drug is used to treat acute opioid overdose? *(p 576)* _____

30. Which drug should be given to treat acute opioid overdose after detoxification? *(p 576)* _____

_____

Answers

PSYCHOLOGY

1. A-4, B-5, C-2, D-3, E -1.

2.

Behavior	Defense Mechanism	Mature or Immature
A football player jokes about playing the defending state champions the following week.	Humor	Mature
A survivor of an earthquake describes the event and her town's destruction with no emotional response.	Isolation (of affect)	Immature
A man wants to cheat on his wife, but instead writes a romance novel that becomes a best-seller.	Sublimation	Mature
Since childhood, a man has been getting away with stomping his feet when upset because nobody has corrected him.	Fixation	Immature
A child throws a temper tantrum when he cannot have candy.	Acting out	Immature
A former heroin addict decides to volunteer at an anti–drug-abuse program at a local school	Altruism	Mature
A man who is angry at his wife responds defensively to her questions, assuming she must also be angry with him	Projection	Immature
A man who is angry at his wife becomes angry at his son.	Displacement	Immature
"How are you taking the diagnosis?" "You mean the cancer? I've got 3 mouths to feed, a living will to establish, medical bills to pay… so I'm not thinking about cancer right now…"	Suppression	Mature

PATHOLOGY

3. Alcohol, drugs, fluid/electrolyte imbalance, head trauma, hypoglycemia, infection, nutritional deficiencies, hypoxia.

4. Treat the underlying medical condition.

5.

Disorder	Criteria	No. of Criteria Needed to Diagnose	Criteria Must be Present How Long?
Major depressive disorder	**D**epressed mood, decreased **I**nterest, **G**uilt or feelings of worthlessness, **S**leep disturbances, **S**uicidal ideation, **P**sychomotor retardation or agitation, **A**ppetite/weight changes, decreased **C**oncentration, decreased **E**nergy, (Remember: **DIGS SPACE**)	5 out of 9	At least 2 weeks
Manic episode	**D**istractibility, **I**mpulsivity/**I**ndiscretion, **G**randiosity, **F**light of ideas, increase in goal-directed **A**ctivity/psychomotor **A**gitation, decreased need for **S**leep, **T**alkativeness or pressured speech (Manics **DIG FAST)**	3 out of 7	At least 1 week
Schizophrenia	Delusions, hallucinations (often auditory), disorganized speech, disorganized or catatonic behavior, negative symptoms (eg, flat affect, social withdrawal)	2 out of 5, with at least one among the first 3 listed	At least one month

6. Psychotherapy.

7. “Weird; wild; worried”, if you use the mnemonic. Alternatively, they are genetically associated with schizophrenia, mood, and anxiety disorders.

8. A-2, B-3, C-2, D-3, E-2, F-2, G-3, H-1, I-1, J-1.

9. Splitting; self-mutilation.

10. Anorexic patients are by definition clinically underweight (BMI < 18.5 kg/m^2). Bulimic patients often have normal or slightly overweight BMI. Bulimic patients by definition MUST binge and purge, but anorexic patients MAY binge and purge as well; therefore, this criterion cannot be used to distinguish the two. Treatments include psychotherapy and nutritional rehabilitation; antidepressants (eg, SSRIs) may be helpful in patients with comorbid depression.

11. For a patient older than 5 years, nighttime urinary incontinence at least twice weekly for at least 3 months.

12. 1. Precontemplation - denying problem

    2. Contemplation - acknowledging problem, but unwilling to change

    3. Preparation/determination—preparing for behavioral changes

    4. Action/willpower - changing behaviors

    5. Maintenance - maintaining changes

    6. Relapse (if applicable) - returning to old behaviors and abandoning changes

13. A-6, B-1, C-7, D-5, E-4, F-2, G-3.

14. Benzodiazepines.

15. With neuroleptic malignant syndrome, one would expect to see Malignant FEVER: **M**yoglobinuria, **F**ever, **E**ncephalopathy, **V**itals unstable, **E**nzymes elevated, muscle **R**igidity. Serotonin syndrome, in contrast, presents with the 3 A's: increased **A**ctivity (neuromuscular; eg, tremor, seizure, hyperreflexia), **A**utonomic instability (hyperthermia, diarrhea, diaphoresis), and **A**ltered mental status.

16. Dilated; constricted.

PHARMACOLOGY

17. A-5, B-10, C-11, D-8, E-9, F-2, G-6, H-1, I-4, J-3, K-7, L-12, M-13.

18. A-5, B-1, C-4, D-2, E-3.

19. SSRIs, venlafaxine, and benzodiazepines.

20. SSRIs, venlafaxine, and clomipramine.

21. Lithium, carbamazepine, valproic acid, lamotrigine, and atypical antipsychotics.

22. SSRIs, SNRIs, and buspirone. Buspirone, because it does not cause sedation.

23. High-potency typical antipsychotics.

24. **A**cute **d**ystonia occurs hours to days after exposure. **A**kathisia and **P**arkinsonism occur days to months later. **T**ardive dyskinesia occurs months to years later. (**ADAPT**)

25. Metabolic syndrome (weight gain, diabetes, dyslipidemia) occur most frequently with olanzapine or clozapine. Clozapine's most feared complication is agranulocytosis.

26. Li**THIUM** adverse effects include **L**ow **T**hyroid (hypothyroidism), **H**eart (Ebstein anomaly), **I**nsipidus (nephrogenic diabetes insipidus), **U**nwanted **M**ovements (tremor), and teratogenesis.

27. TCAs and SNRIs block reuptake of norepinephrine and serotonin. SSRIs and trazodone block reuptake of serotonin exclusively.

28. Nortriptyline has fewer anticholinergic adverse effects than third-generation TCAs such as amitriptyline.

29. Naloxone.

30. Naltrexone.

Renal

Questions

EMBRYOLOGY

1. What are the four causes of Potter sequence? *(p 578)* _____

_____

2. Which genetic diseases are associated with horseshoe kidney? *(p 579)* _____

_____

3. What error in development occurs that results in unilateral renal agenesis? *(p 579)* _____

_____

4. What is the most common cause of bladder outlet obstruction in male infants? *(p 579)* _____

_____

ANATOMY

5. Why is the left kidney harvested for transplantation rather than the right? *(p 580)* _____

_____

6. Ureters pass _____ (over/under) the uterine artery or the vas deferens. *(p 581)*

PHYSIOLOGY

7. What is the 60-40-20 rule of total body weight? *(p 581)* _____

_____

8. The fenestrated capillary endothelium of the glomerular filtration barrier is responsible for the filtration of plasma by which characteristic: size or charge? *(p 581)* _____

9. The epithelial layer of the glomerular filtration barrier is formed by which cells? *(p 581)* _____

_____

10. What is the formula for calculating the clearance of substance X, the volume of plasma from which the substance is completely cleared per unit of time? *(p 582)* _____

_____

11. If renal clearance is greater than the glomerular filtration rate (GFR) of substance X, then there is a net tubular _____ (reabsorption/secretion) of substance X. *(p 582)*

12. Creatinine clearance slightly _____ (overestimates/underestimates) the GFR rate because creatinine is _____ (secreted/reabsorbed) by the renal tubules. *(p 582)*

13. What is the formula for estimating renal blood flow if renal plasma flow is known? *(p 582)*

_____

14. What are the effects of prostaglandins on the glomerulus? *(p 583)* _____

_____

15. What are the effects of angiotensin II on the glomerulus? *(p 583)* _____

_____

16. Decreased plasma protein concentration causes _____ (decrease/increase/no change) in renal plasma flow and _____ (decrease/increase/no change) in GFR, which results in _____ (decrease/increase/no change) in the filtration fraction. *(p 583)*

17. Constriction of the afferent arteriole causes _____ (decrease/increase/no change) in renal plasma flow and _____ (decrease/increase/no change) in GFR, which results in _____ (decrease/increase/no change) in the filtration fraction. *(p 583)*

18. What is the formula for excretion rate? *(p 584)* _____

19. In the nephron, glucose at normal plasma concentrations is reabsorbed in which structure? And by which transporter? *(p 584)* _____

20. At what plasma glucose concentration is the transport mechanism of the proximal tubule completely saturated, leading to glucose spilling into the urine? *(p 584)* _____

21. What ion is secreted into the lumen of the early proximal convoluted tubule and can complex with bicarbonate for reabsorption? *(p 585)* _____

22. Which three ions are actively reabsorbed in the thick ascending loop of Henle? *(p 585)* _____

_____

23. Which two ions are indirectly reabsorbed in the thick ascending loop of Henle? *(p 585)* _____

_____

24. Which hormone controls the reabsorption of calcium in the early distal convoluted tubule? *(p 585)*

_____

25. On which segment of the nephron does the hormone aldosterone act? *(p 585)* _____

_____

26. ADH's effect at V_2 receptors results in what action? *(p 585)* _____

_____

27. The ratio of solute concentration in the tubular fluid versus plasma (TF/P) can indicate the level of secretion or reabsorption of that solute along the proximal convoluted tubule. If the TF/P ratio of that solute is less than that of inulin, there is net _____ (reabsorption/secretion) along the proximal tubule. *(p 587)*

28. Along the length of the proximal convoluted tubule, does the relative concentration of chloride increase, decrease, or stay the same? *(p 587)* _____

29. Which actions of angiotensin II serve to increase intravascular volume and/or blood pressure? *(p 588)* _____

_____

30. Where is angiotensin-converting enzyme (ACE) primarily located? *(p 588)* _____

_____

31. ADH primarily regulates _____ _____ (serum osmolarity/blood volume), whereas aldosterone primarily regulates _____ _____ (serum osmolarity/ECF volume). In _____ (low/high) volume states, both ADH and aldosterone act to protect _____ _____ (serum osmolarity/blood volume). *(p 588)*

32. What are the effects of aldosterone secretion? *(p 588)* _____

_____

_____

_____

33. When blood pressure falls, the kidneys compensate by releasing which enzyme? *(p 589)*

_____

34. Which cells in the kidney secrete renin? *(p 589)* _____

35. Which hormone is released by the interstitial cells of renal peritubular capillaries in response to hypoxia? *(p 589)* _____

36. Which enzyme from the kidney is activated by PTH, and what is the function of that enzyme? *(p 589)* _____

37. Atrial natriuretic peptide is secreted in response to _____ (decreased/increased) atrial pressure and causes the GFR to _____ (decrease/increase). *(p 590)*

38. In the chart below, check the effect that each condition has on the potassium shift. *(p 590)*

Effect	Shifts K^+ into Cell → Hypokalemia	Shifts K^+ out of Cell → Hyperkalemia
Acidosis		
Alkalosis		
β-adrenergic agonists		
β-blocker		
Lysis of cells		
Digitalis		
Hyperosmolarity		
Hypo-osmolarity		
Insulin		
High Blood Sugar (insulin deficiency)		

39. By what mechanism does insulin cause hypokalemia? *(p 590)* _____

_____

40. What is the primary electrolyte disturbance in metabolic acidosis? *(p 592)* _____

_____

41. What is the immediate respiratory response to metabolic acidosis, and does P_{CO_2} increase or decrease? *(p 592)* _____

42. What are the nine causes of increased anion gap metabolic acidosis? *(p 592)* _____

_____

_____

PATHOLOGY

43. What glomerular diseases can be considered both nephritic and nephrotic syndromes? *(p 595)*

_____

44. What five clinical findings are associated with nephritic syndrome? *(p 595)* _____

_____

45. What four clinical findings are associated with nephrotic syndrome? *(p 595)* _____

_____

46. A 10-year-old boy presents with periorbital edema and cola-colored urine, which are both beginning to resolve without intervention. Electron microscopy of a kidney biopsy specimen shows subepithelial immune complex (IC) humps. Which form of nephritic syndrome does he most likely have? *(p 596)* _____

47. Match the nephritic syndrome with its characteristic finding on microscopy. *(p 596)*

_____ A. Acute poststreptococcal glomerulonephritis	1. Crescent-moon shape on LM
_____ B. Alport syndrome	2. IC deposits in mesangium
_____ C. Diffuse proliferative glomerulonephritis	3. Subepithelial IC humps on EM
_____ D. IgA nephropathy	4. Split basement membrane
_____ E. Rapidly progressive glomerulonephritis	5. “Wire looping” of capillaries on LM
_____ F. Membranoproliferative glomerulonephritis	6. “Tram-track” appearance on H&E, PAS

48. Granulomatosis with polyangiitis (Wegener) is _____ (PR3-ANCA/c-ANCA or MPO-ANCA/p-ANCA) positive, whereas microscopic polyangiitis is _____ (PR3-ANCA/c-ANCA or MPO-ANCA/p-ANCA) positive. *(p 596)*

49. Diffuse proliferative glomerulonephritis and membranoproliferative glomerulonephritis can present as either _____ or _____ syndrome. *(p 596)*

50. Match the nephrotic syndrome with its characteristic finding. *(p 597)*

_____ A. Amyloidosis	1. Associated with chronic disease
_____ B. Diabetic glomerulonephropathy	2. Podocyte foot process effacement on EM
_____ C. Focal segmental glomerulosclerosis	3. Hyalinosis, segmented sclerosis on LM
_____ D. Membranous nephropathy	4. Kimmelstiel-Wilson lesion on LM
_____ E. Minimal change disease .	5. “Spike-and-dome appearance” on EM

51. What is the most common cause of nephrotic syndrome in African Americans and Hispanics? *(p 597)* _____

52. In diabetic glomerulonephropathy, what causes mesangial expansion? *(p 597)* _____

_____

53. Kidney stones are most commonly composed of what element? *(p 598)* _____

_____

54. Both antifreeze and vitamin C abuse can result in the formation of which type of crystals? *(p 598)*

_____

55. An 80-year-old man with leukemia presents with hematuria and right-sided flank pain. Which type of kidney stone is he most likely to have? And how would this stone appear on x-ray? *(p 598)* _____

_____

_____

56. Match the renal pathology with its characteristic findings. *(pp 600-602, 605-606)*

_____ A. Acute pyelonephritis
_____ B. Acute tubular necrosis
_____ C. Squamous cell bladder carcinoma
_____ D. Chronic pyelonephritis
_____ E. Diffuse cortical necrosis
_____ F. Acute interstitial nephritis
_____ G. Renal cell carcinoma
_____ H. Renal papillary necrosis
_____ I. Urothelial carcinoma
_____ J. Wilms tumor

1. Associated with aniline dye exposure
2. Associated with diabetes
3. Associated with obstetric catastrophe
4. Associated with paraneoplastic syndromes
5. Granular muddy brown casts in urine
6. Nephroblastoma
7. Hematuria, no casts
8. Pyuria and azotemia
9. Thyroidization of kidney
10. WBC casts in urine

57. Which three general types of renal dysfunction can lead to acute kidney injury? *(p 601)* _____

_____

58. True or false: Unilateral postrenal outflow obstruction can lead to acute kidney injury. *(p 601)* ____

_____

59. A patient's urine osmolarity is <350 mOsm/kg, urine sodium level is >40 mEq/L, fractional excretion of sodium is >4%, and BUN/creatinine ratio is >15:1. Is the cause of the acute renal failure most likely to be prerenal, renal, or postrenal? *(p 601)* _____

60. A patient's urine osmolarity is >500 mOsm/kg, urine sodium level is <10 mEq/L, fractional excretion of sodium is <1%, and BUN/creatinine ratio is >20:1. Is the cause of the acute renal failure most likely to be prerenal, renal, or postrenal? *(p 601)* _____

61. What are the eight consequences of renal failure represented by the mnemonic **MAD HUNGER**? *(p 603)* _____

_____

62. What is the most common cause of secondary hypertension in adults? What other vascular pathology is usually involved? *(p 604)* _____

_____

63. What gene is mutated in autosomal dominant polycystic kidney disease? *(p 604)*

_____

64. What are the two major complications associated with autosomal dominant polycystic kidney disease? *(p 604)* _____

_____

65. What are the complications of autosomal recessive polycystic kidney disease in utero and after the neonatal period? *(p 604)* _____

_____

_____

66. Name the four components of the WAGR complex. *(p 606)* _____

_____

PHARMACOLOGY

67. What is the mechanism of action of acetazolamide? *(p 608)* _____

_____

68. What is the mechanism of action of furosemide? *(p 608)* _____

_____

_____

69. Which loop diuretic is used for diuresis in patients who are allergic to sulfa drugs? *(p 608)* _____

_____

70. What are the effects of hydrochlorothiazide toxicity? *(p 609)* _____

_____

71. What is the mechanism of action of spironolactone? *(p 609)* _____

_____

72. What is the mechanism by which ACE inhibitors can cause angioedema? *(p 610)* _____

_____

_____

73. What are three clinical uses of ACE inhibitors? *(p 610)* _____

_____

_____

Answers

EMBRYOLOGY

1. ARPKD, obstructive uropathy (eg, posterior urethral valves), bilateral renal agenesis, and chronic placental insufficiency.

2. Turner syndrome; trisomies 13, 18, 21.

3. Ureteric bud fails to develop and induce differentiation of metanephric mesenchyme.

4. Posterior urethral valves.

ANATOMY

5. Because the left kidney has a longer renal vein.

6. Under. (Remember: Water [ureters] flows under the bridge [uterine artery or vas deferens]."")

PHYSIOLOGY

7. 60% of body weight is made up of total body water, 40% is made up of intracellular fluid, and 20% is made up of extracellular fluid.

8. Size.

9. Podocyte foot processes.

10. Renal clearance of X = the urine concentration of X times the urine flow rate, divided by the plasma concentration of X [$C_x = (U_x V)/P_x$].

11. Secretion.

12. Overestimates; secreted. (The plasma concentration of creatinine is slightly lower than it would be from filtration alone.)

13. Renal blood flow = renal plasma flow divided by (1 – the hematocrit), or RBF = RPF/(1 – Hct).

14. Prostaglandins cause dilation of the afferent arteriole and an increase in the GFR.

15. Angiotensin II causes constriction of the efferent arteriole and an increase in the GFR.

16. No change; increase; increase.

17. Decrease; decrease; no change.

18. Excretion rate = $V \times U_x$; where V is the urine flow rate and U_x is the urine concentration of X.

19. Glucose is reabsorbed in the proximal convoluted tubule (PCT) by a Na+/glucose cotransport.

20. ~375 mg/dL.

21. Hydrogen ions.

22. Sodium, potassium, and chloride.

23. Magnesium and calcium.

24. PTH.

25. Collecting tubule.

26. Insertion of aquaporin water channels on the apical side of the collecting tubules.

27. Reabsorption.

28. Increase. (Chloride reabsorption occurs at a slower rate in the early PCT causing an initial rise in the TF/P ratio relative to other ions.)

29. Vasoconstriction; aldosterone release and aldosterone-mediated stimulation of sodium resorption in the proximal tubule; release of ADH from the posterior pituitary; and simulation of thirst via the hypothalamus.

30. Pulmonary endothelium.

31. Serum osmolarity; ECF volume; low; blood volume.

32. Aldosterone secretion from the adrenal cortex increases sodium channel and sodium/potassium pump insertion in principal cells and enhances potassium and hydrogen excretion by upregulating channels in the principal cells and hydrogen ion channels in the intercalated cells. These actions create a favorable gradient for sodium and water reabsorption.

33. Renin.

34. Juxtaglomerular (JG) cells.

35. Erythropoietin.

36. 1α-Hydroxylase, which converts 25-OH vitamin D_3 to 1,25-$(OH)_2$ vitamin D_3 (calcitriol, active form).

37. increased; increase.

38.

Effect	Shifts K^+ Into Cell →Hypokalemia	Shifts K^+ Out of Cell → Hyperkalemia
Acidosis		√
Alkalosis	√	
β-adrenergic agonists	√	
β-blocker		√
Lysis of cells		√
Digitalis		√
Hyperosmolarity		√
Hypo-osmolarity	√	
Insulin	√	
High Blood Sugar (insulin deficiency)		√

39. Insulin increases activity of the Na^+/K^+ ATPase pump. This increases the amount of K^+ pumped into the cell in exchange for Na^+, thus leaving less K^+ outside the cell.

40. Decreased serum bicarbonate.

41. Hyperventilation, which causes P_{CO_2} to decrease.

42. **M**ethanol (formic acid), **U**remia, **D**iabetic ketoacidosis, **P**ropylene glycol, **I**ron tablets or **I**NH, **L**actic acidosis, **E**thylene glycol (oxalic acid), and **S**alicylates (late). Remember: **MUDPILES**.

PATHOLOGY

43. Diffuse proliferative glomerulonephritis and membranoproliferative glomerulonephritis.

44. Azotemia (↑ BUN and creatine), oliguria, hypertension, hematuria, RBC casts in urine, and HTN proteinuria often in the subnephrotic range (< 3.5 g/day).

45. Massive proteinuria (> 3.5 g/day), with hypoalbuminemia, edema, and frothy urine with fatty casts.

46. Acute poststreptococcal glomerulonephritis.

47. A-3, B-4, C-5, D-2, E-1, F-6.

48. PR3-ANCA/c-ANCA; MPO-ANCA/p-ANCA.

49. Nephrotic or nephritic syndrome.

50. A-1, B-4, C-3, D-5, E-2.

51. Focal segmental glomerular sclerosis.

52. Nonenzymatic glycation of tissue proteins, leading to an increased GFR and thus mesangial expansion.

53. Calcium in the form of calcium oxalate.

54. Oxalate crystals.

55. The patient's leukemia (a disease with high cell turnover) can result in hyperuricemia, so he is at risk for developing uric acid stones, which are radiolucent and do not appear on x-ray studies, but are visible on CT and ultrasound.

56. A-10, B-5, C-7, D-9, E-3, F-8, G-4, H-2, I-1, J-6.

57. Prerenal azotemia (eg, hypotension and reduced renal blood flow), intrinsic renal failure (eg, tubular necrosis), and postrenal azotemia (outflow obstruction).

58. False; bilateral (not unilateral) postrenal outflow obstruction leads to acute renal failure.

59. Postrenal.

60. Prerenal.

61. **M**etabolic **A**cidosis, **D**yslipidemia, **H**igh potassium, **U**remia, **N**a^+/H_2O retention, **G**rowth retardation and developmental delay, **E**rythropoietin deficiency (anemia), **R**enal osteodystrophy.

62. Renal artery stenosis or microvascular disease. As this is an atherosclerotic disease, atherosclerosis of other vessels is common (coronary artery disease, peripheral arterial disease, etc.).

63. *PKD1* or *PKD2* gene.

64. Chronic kidney disease and hypertension (due to increased renin production).

65. Renal failure in utero from autosomal recessive polycystic kidney disease can lead to Potter sequence (page 578). After the neonatal period, potential complications include systemic hypertension, portal hypertension from congenital hepatic fibrosis, and progressive renal insufficiency.

66. **WAGR** complex = **W**ilms tumor, **A**niridia, **G**enitourinary malformations, and mental **R**etardation/ intellectual disability.

PHARMACOLOGY

67. Acetazolamide acts as a carbonic anhydrase inhibitor, causing self-limited sodium bicarbonate diuresis and a reduction in total-body bicarbonate stores.

68. Furosemide inhibits the $Na^+/K^+/2Cl^-$ cotransport system in the thick ascending limb of the loop of Henle, thereby abolishing the hypertonicity of the medulla and preventing the concentration of urine.

69. Ethacrynic acid.

70. Hypokalemic metabolic alkalosis, hyponatremia, hyper**G**lycemia, hyper**L**ipidemia, hyper**U**ricemia, and hyper**C**alcemia. Remember: Hyper**GLUC.**

71. Spironolactone competitively antagonizes the aldosterone receptor in the cortical collecting tubule.

72. ACE inhibitors prevent the inactivation of bradykinin, a potent vasodilator. Increased bradykinin levels can lead to angioedema in susceptible individuals.

73. To treat hypertension, proteinuria, heart failure, and to slow the progression of diabetic nephropathy.

Respiratory

Questions

EMBRYOLOGY

1. At which week does respiration become possible? During which phase of lung development does this occur? *(p 660)* _____

2. _____ (Type I/Type II) pneumocytes proliferate during lung damage. *(p 661)*

3. What is the function of surfactant? *(p 661)* _____

   _____

4. What are the risk factors for neonatal respiratory distress syndrome? *(p 661)* _____

   _____

5. What is the treatment of neonatal respiratory distress syndrome prior to birth? *(p 661)* _____

   _____

6. Name three conditions that can result from therapeutic oxygen supplementation in neonatal respiratory distress syndrome. *(p 661)* _____

   _____

ANATOMY

7. Match the functions and characteristics with the cell type that best describes them. (Numbers may be used more than once.) *(pp 661-662)*

_____ A. Ciliated, clears mucus from lungs
_____ B. Phagocytose foreign material from alveoli
_____ C. Comprise 3% of pneumocytes
_____ D. Cuboidal and clustered
_____ E. Degrade toxins
_____ F. 97% of alveolar surfaces
_____ G. Nonciliated
_____ H. Precursors to type I and II pneumocytes
_____ I. Secrete surfactant
_____ J. Squamous cells

1. Club cells
2. Alveolar macrophages
3. Pseudostratified ciliated columnar cells
4. Type I pneumocytes
5. Type II pneumocytes

8. Which seven structures make up the conducting zone of the respiratory tree? *(p 662)* _____

_____

_____

9. What are the three main functions of the conducting zone of the respiratory tree? *(p 662)* _____

_____

10. Which anatomic structures are encompassed by the respiratory zone, and what is their major function? *(p 662)* _____

_____

11. If you aspirate a peanut while standing upright, into which part of the lungs will it most likely go? *(p 663)* _____

12. If you aspirate a peanut while supine, into which part of the lungs will it most likely go? *(p 663)*

_____

13. Match the structure and the thoracic vertebral level where it crosses the diaphragm. (Numbers may be used more than once.) *(p 663)*

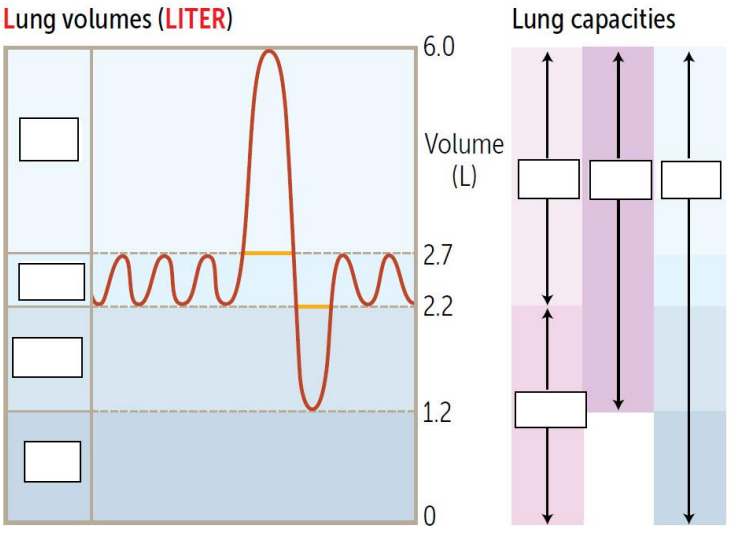
_____ A. Aorta	1. T8
_____ B. Azygous vein	2. T10
_____ C. Esophagus	3. T12
_____ D. Inferior vena cava	
_____ E. Thoracic duct	
_____ F. Vagus	

PHYSIOLOGY

14. Match the term with its description. *(p 664)*

_____ A. Air that can be inspired after a normal breath	1. ERV
_____ B. Air remaining in lung after maximal expiration	2. FRC
_____ C. Air that can still be exhaled after normal expiration	3. IC
_____ D. Air that moves into lung with each quiet inspiration	4. IRV
_____ E. IRV + TV	5. RV
_____ F. IRV + TV + ERV + RV	6. TLC
_____ G. RV + ERV	7. TV
_____ H. TV + IRV + ERV	8. VC

15. In the image below, fill in the rectangles to describe the lung volume measurement. *(p 664)*



16. What are the components of physiologic dead space? *(p 664)* _____

_____

17. In which conditions is lung compliance decreased? *(p 665)* _____

_____

18. In the chart below, note whether the respiratory changes listed increase, decrease, or remain the same for the elderly. *(p 665)*

Condition	Change
A-a gradient	
Chest wall compliance	
Chest wall stiffness	
FVC and FEV_1	
Lung compliance	
Respiratory muscle strength	
RV	
TLC	
V/Q mismatch	
Ventilatory response to hypoxia/hypercapnia	

19. Which has a greater affinity for O_2, fetal or adult Hb? *(p 666)* _____

20. How does methemoglobinemia present and how is it treated? *(p 666)* _____

_____

_____

21. When the oxygen-hemoglobin dissociation curve shifts to the right, the Hb affinity for O_2 _____ (decreases/increases). When the oxygen-hemoglobin dissociation curve shifts to the left, the Hb affinity for O_2 _____ (decreases/increases). *(p 666)*

22. In the chart below, indicate whether the effect shifts the oxygen-hemoglobin dissociation curve to the left or to the right. *(p 666)*

Effect	Shift to the Left	Shift to the Right
Decreased 2,3-BPG		
Decreased pH		
Decreased temperature		
Fetal hemoglobin		
High altitude		
Increased 2,3-BPG		
Increased pH		
Increased temperature		

23. What is the treatment for cyanide poisoning? *(p 667)* _____

_____

24. What gases are perfusion limited when diffusing into the pulmonary capillary? *(p 668)* _____

_____

25. How is the A-a gradient calculated? *(p 668)* _____

_____

26. Which two processes lead to hypoxemia with a normal A-a gradient? *(p 669)* _____

_____

27. Which three processes can lead to hypoxemia with an increased A-a gradient? *(p 669)* _____

_____

28. Name five processes that can lead to hypoxia (decreased O_2 delivery to tissue). *(p 669)* _____

_____

29. With respect to the lung apex (zone 1), arrange the following in order of increasing pressure: artery, vein, alveolus. *(p 669)* _____

30. With respect to zone 2 of the lung, arrange the following in order of increasing pressure: artery, vein, alveolus. *(p 669)* _____

31. With respect to the lung base (zone 3), arrange the following in order of increasing pressure: artery, vein, alveolus. *(p 669)* _____

32. In which forms is CO_2 transported from the tissues to the lungs? *(p 670)* _____

_____

33. What enzyme catalyzes the conversion of CO_2 and water into carbonic acid? *(p 670)* _____

_____

34. When oxygen binds to hemoglobin in the lungs, how does it affect the relationship between CO_2 and hemoglobin? What is this effect called? *(p 670)* _____

_____

_____

35. In peripheral tissues, an increase of H^+ from tissue metabolism shifts the oxygen-hemoglobin dissociation curve to the right, resulting in an unloading of O_2. What is the name for this effect? *(p 670)* _____

36. For each item in the chart below, indicate whether altitude or exercise would induce the response. *(p 670)*

Effect	Response to Altitude	Response to Exercise
Decreased pH		
Increased 2,3-BPG		
Increased CO_2 production		
Increased erythropoietin		
Increased O_2 consumption		
Increased mitochondria		
Increased pulmonary blood flow		
Increased renal excretion of HCO_3^-		
Increased ventilation rate		
More uniform V/Q ratio from apex to base		
Right ventricular hypertrophy		

PATHOLOGY

37. Which three factors that promote blood coagulation are collectively known as Virchow triad?

(p 671) _____

38. Name the six most common causes of emboli to the lungs. *(p 672)* _____

_____

39. For each patient, indicate the most likely type of pulmonary embolus. *(p 672)*

A. A 30-year-old postpartum woman presenting with hypoxia, hypotension, and DIC. Histology shows fetal squamous cells. _____

B. An 18-year-old man who sustained a femur fracture after a motor vehicle collision accident is now developing hypoxemia, altered mental status, and a petechial rash. _____

C. A 35-year-old professional scuba diver _____

D. An 83-year-old woman with a history of right calf swelling and erythema is now presenting with shortness of breath and chest pain. _____

40. For each patient, indicate the most likely type of mediastinal pathology. *(p 672)*

A. A 30-year-old woman complaining of muscle weakness that worsens towards the end of the day. CT of the chest shows a mass in the anterior mediastinum which is a(n) _____.

B. A 55-year-old man with a history of hypertension presents with tearing chest pain radiating to the back. A chest x-ray shows a widened mediastinum indicating a(n) _____.

C. A 47-year-old year old man recently underwent a cardiac surgery 4 days ago, and now has developed fever, tachycardia, tachypnea and sternal wound drainage. He is diagnosed with _____.

D. Subcutaneous emphysema, as well as crepitus on palpation or auscultation of the chest is a sign of _____, which may be caused by _____ or _____ _____.

41. Match the characteristic finding with the obstructive lung disease with which it is associated. (Numbers may be used more than once.) *(pp 674-675)*

_____ A. Associated with Kartagener syndrome
_____ B. Chronic productive cough
_____ C. Curschmann spirals
_____ D. Hyperplasia of mucus-secreting glands
_____ E. Increased lung compliance
_____ F. Associated with allergic bronchopulmonary aspergillosis
_____ G. Whorled mucous plugs
_____ H. Permanently dilated airways
_____ I. Reid index > 50%
_____ J. Results from hyperresponsiveness of bronchi
_____ K. Destruction of alveolar walls
_____ L. Wheezing and crackles on auscultation

1. Asthma
2. Bronchiectasis
3. Chronic bronchitis
4. Emphysema

42. Patients with restrictive lung disease have a _____ (higher/lower) FEV_1/FVC ratio than normal. *(p 675)*

43. What type of hypersensitivity reaction is involved in hypersensitivity pneumonitis? *(p 675)* _____

_____

44. What bronchoscopy findings are associated with smoke- and fire-based inhalation injury at 18 hours post-injury? *(p 676)* _____

45. Which pneumoconioses are associated with an increased incidence of bronchogenic carcinoma? *(p 677)* _____

46. Match the lung cancer with its characteristic. (Numbers may be used more than once.) *(pp 678, 684)*

_____ A. *KRAS, EGFR, ALK* mutations
_____ B. Associated with asbestosis
_____ C. Forms keratin pearls
_____ D. Chromogranin A, neuron-specific enolase and synaptophysin positive
_____ E. Amplification of *myc* oncogenes common
_____ F. May lead to Lambert-Eaton syndrome
_____ G. May produce ACTH or SIADH
_____ H. Most common lung cancer among nonsmokers
_____ I. Parathyroid-like activity
_____ J. Pleomorphic giant cells
_____ K. Neoplasm of neuroendocrine Kulchitsky cells
_____ L. Psammoma bodies on histology
_____ M. Risk factors include smoking

1. Adenocarcinoma
2. Large cell carcinoma
3. Mesothelioma
4. Small cell carcinoma
5. Squamous cell carcinoma

47. What are the causes for acute respiratory distress syndrome? *(p 678)* _____

_____

48. What is central sleep apnea? *(p 679)* _____

_____

49. What is obstructive sleep apnea? *(p 679)* _____

_____

50. Match the physical examination finding with its associated pathology. *(p 680)*

_____ A. Dullness to percussion with ↓ fremitus
_____ B. Dullness to percussion with ↑ fremitus
_____ C. Tracheal deviation away from lesion side
_____ D. Tracheal deviation toward lesion side

1. Atelectasis
2. Lobar pneumonia
3. Pleural effusion
4. Tension pneumothorax

51. Describe four etiologies of atelectasis. *(p 680)* _____

_____

_____

_____

52. Name three causes of transudative pleural effusions. *(p 681)* _____

_____

53. Name four causes of exudative pleural effusions. *(p 681)* _____

_____

54. A tall, thin man comes to the ER because of right-sided chest pain and dyspnea. On exam, there are diminished breath sounds on the right side and hyperresonance to percussion. What type of pneumothorax is most likely? *(p 682)* _____

_____

55. Match the organism with the most likely pneumonia type. (There may be more than one correct pneumonia type, and numbers may be used more than once.) *(p 683)*

_____ A. Adenovirus, influenza
_____ B. *Chlamydophila pneumoniae, psittaci*
_____ C. *Haemophilus influenzae*
_____ D. *Klebsiella*
_____ E. *Legionella*
_____ F. *Mycoplasma*
_____ G. RSV, CMV
_____ H. *Staphylococcus aureus*
_____ I. *Streptococcus pneumoniae*

1. Bronchopneumonia
2. Lobar pneumonia
3. Interstitial pneumonia

56. What are the four most common sites of metastases from lung cancer? *(p 684)* _____

_____

57. What are the three findings of Horner syndrome? *(p 685)* _____

_____

58. What organisms are most likely found in a lung abscess? *(p 685)* _____

_____

PHARMACOLOGY

59. What is the mechanism of action of dextromethorphan? *(p 686)* _____

_____

60. With respect to toxicity, what is the main difference between first- and second-generation H_1 histamine blockers? *(p 686)* _____

_____

61. What is the mechanism of action of bosentan? *(p 686)* _____

_____

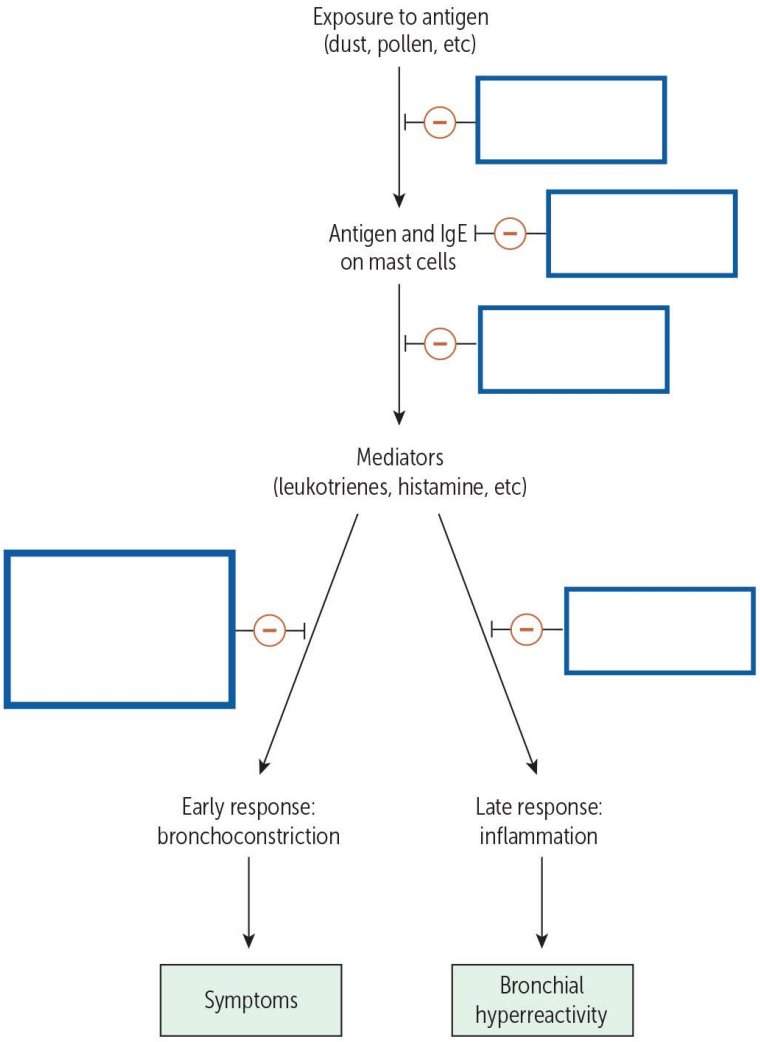
62. What is the mechanism of action of albuterol? *(p 687)* _____

_____

63. Ipratropium is a member of which class of drugs? *(p 687)* _____

_____

64. In the image below, fill in the rectangles to identify the treatments for asthma. *(p 687)*



Answers

EMBRYOLOGY

1. Week 25: Canalicular phase.

2. Type II.

3. Decreases alveolar surface tension, alveolar collapse, lung recoil, and increases compliance.

4. Prematurity, maternal diabetes, and caesarean delivery.

5. Maternal steroids.

6. Retinopathy of prematurity, intraventricular hemorrhage, and bronchopulmonary dysplasia.

ANATOMY

7. A-3, B-2, C-5, D-5, E-1, F-4, G-1, H-5, I-5, J-4.

8. Nose, pharynx, larynx, trachea, bronchi, bronchioles, and terminal bronchioles.

9. The conducting zone warms, humidifies, and filters the air.

10. The lung parenchyma: respiratory bronchioles, the alveolar ducts, and alveoli, all of which participate in gas exchange.

11. Usually enters the right lower lobe.

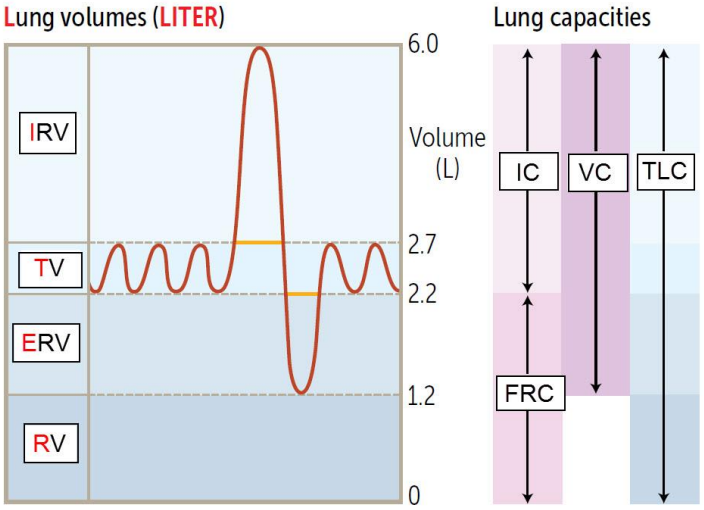
12. Usually enters the superior segment of the right lower lobe.

13. A-3, B-3, C-2, D-1, E-3, F-2.

PHYSIOLOGY

14. A-4, B-5, C-1, D-7, E-3, F-6, G-2, H-8.

15.



16. Anatomic dead space of conducting airways and alveolar dead space.

17. In states of pulmonary fibrosis, pneumonia, ARDS, pulmonary edema, and decreased surfactant production.

18.

Condition	Change
A-a gradient	↑
Chest wall compliance	↓
Chest wall stiffness	↑
FVC and FEV_1	↓
Lung compliance	↑
Respiratory muscle strength	↓
RV	↑
TLC	same
V/Q mismatch	↑
Ventilatory response to hypoxia/hypercapnia	↓

19. Fetal Hb.

20. Methemoglobinemia may present with hypoxemia, neurological symptoms like headache and altered mental status, cardiac symptoms like shortness of breath, as well as cyanosis (depending on the concentration of MetHb in the blood) and chocolate-colored blood. It can be treated with methylene blue and vitamin C.

21. Decreases; increases.

22.

Effect	Shift to the Left	Shift to the Right
Decreased 2,3-BPG	√	
Decreased pH		√
Decreased temperature	√	
Increased Fetal hemoglobin	√	
High altitude		√
Increased 2,3-BPG		√
Increased pH	√	
Increased temperature		√

23. Treat with hydroxocobalamin, nitrites, or sodium thiosulfate.

24. Oxygen (in normal health), carbon dioxide, and nitrous oxide (N_2O, not to be confused with nitric oxide, NO).

25. A-a gradient = $P_{AO2} – P_{aO2}$; normal A-a gradient is estimated as (age/4) + 4. For a person < 40 years old, gradient should be < 14mm Hg.

26. High altitude and hypoventilation (eg, opioid use, obesity hypoventilation syndrome).

27. Ventilation/perfusion mismatch, diffusion limitation, and right-to-left shunt.

28. Hypoxemia, anemia, carbon monoxide poisoning, ischemia, and decreased cardiac output.

29. Vein < artery < alveolus.

30. Vein < alveolus < artery.

31. Alveolus < vein < artery.

32. As HCO_3^- (bicarbonate), bound to hemoglobin as $HBCO_2$ (carbaminohemoglobin), and dissolved CO_2.

33. Carbonic anhydrase.

34. In the lungs, oxygenation of Hb promotes dissociation of H^+ from Hb. This shifts equilibrium toward CO_2 formation; therefore, CO_2 is released from RBCs. This is known as the Haldane effect.

35. The Bohr effect.

36.

Effect	Response to Altitude	Response to Exercise
Decreased pH		√
Increased 2,3-BPG	√	
Increased CO_2 production		√
Increased erythropoietin	√	
Increased O_2 consumption		√
Increased mitochondria	√	
Increased pulmonary blood flow		√
Increased renal excretion of bicarbonate	√	
Increased ventilation rate	√	√
More uniform V/Q ratio from apex to base		√
Right ventricular hypertrophy	√	

PATHOLOGY

37. **S**tasis, **h**ypercoagulability, and **e**ndothelial damage (Remember **SHE**).

38. **F**at, **a**ir, **t**hrombus, **b**acteria, **a**mniotic fluid, and **t**umor. Remember: An embolus moves like a **FAT BAT**.

39. A = amniotic fluid; B = fat; C = air; D = thrombus.

40. A. Thymic tumor/thymoma (associated with myasthenia gravis).

    B. Aortic dissection.

    C. Acute mediastinitis.

    D. Pneumomediastinum; ruptured pulmonary blebs, trauma, esophageal perforation (i.e. Boerhaave syndrome).

41. A-2, B-3, C-1, D-3, E-4, F-2, G-1, H-2, I-3, J-1, K-4, L-3.

42. Higher.

43. Mixed type III/IV hypersensitivity reaction to environmental antigen.

44. 1) Severe edema, 2) Congestion of bronchus, 3) Soot deposition

45. Asbestosis and silicosis.

46. A-1, B-3, C-5, D-4, E-4, F-4, G-4, H-1, I-5, J-2, K-4, L-3, M-1/2/4/5.

47. Sepsis, pancreatitis, pneumonia, aspiration, and trauma.

48. Impaired respiratory effort due to CNS injury/toxicity, HF, opioids.

49. Respiratory effort against airway obstruction. Associated with obesity, loud snoring, daytime sleepiness.

50. A-3, B-2, C-4, D-1.

51. Obstructive—airway obstruction prevents new air from reaching distal airways, old air is resorbed

    Compressive—external compression on lung decreases lung volumes

    Contraction (cicatrization)—scarring of lung parenchyma that distorts alveoli

    Adhesive—due to lack of surfactant.

52. ↑ hydrostatic pressure, (eg, HF, Na^+ retention) or ↓ oncotic pressure (eg, nephrotic syndrome and cirrhosis).

53. Malignancy, inflammation/infection (eg, pneumonia, collagen vascular disease), and trauma.

54. Primary spontaneous pneumothorax due to rupture of apical subpleural blebs.

55. A-3, B-3, C-1, D-1 and 2, E-2 and 3, F-3, G-3, H-1, I-1 and 2.

56. Adrenals, brain, bone, and liver.

57. Ipsilateral ptosis, miosis, anhidrosis.

58. *Staphylococcus aureus*, *Bacteroides*, *Fusobacterium*, and *Peptostreptococcus*.

PHARMACOLOGY

59. Antitussive. It antagonizes NMDA glutamate receptors.

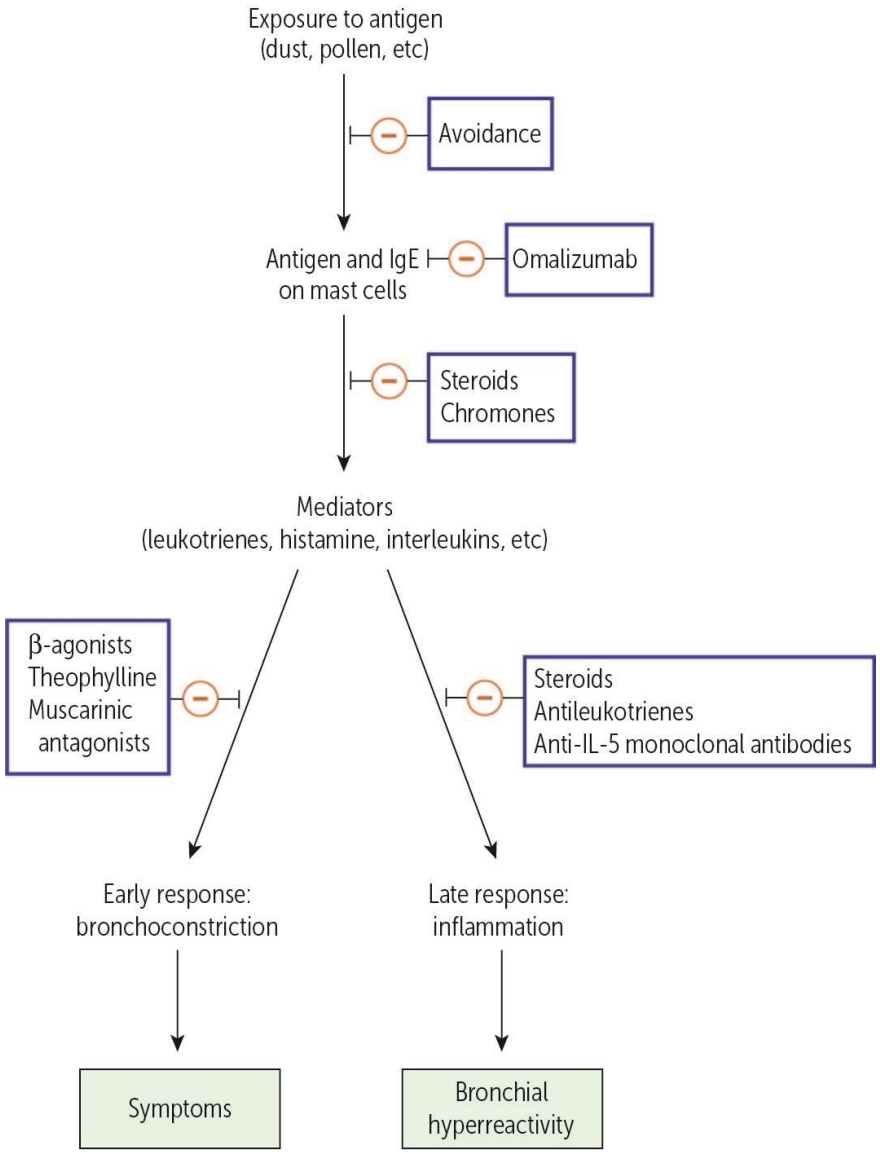
60. Second-generation H_1 histamine blockers are far less sedating because their CNS penetration is lower than that of first-generation agents.

61. It is a competitive antagonist of endothelin-1 receptors.

62. Albuterol relaxes bronchial smooth muscle; it is a short acting β_2-agonist.

63. Muscarinic antagonists.

64.



Reproductive

Questions

EMBRYOLOGY

1. Place a checkmark in the appropriate column for the embryologic origin of the organs. *(p 613)*

Embryologic Derivative	Ectoderm	Mesoderm	Endoderm
Adenohypophysis			
Muscle			
Gut tube epithelium			
Brain			
Wall of gut tube			
PNS ganglia			
Most of urethra and lower vagina			
Bone			
Kidneys			
Oligodendrocytes			
Spleen			
Parathyroid			

2. Describe the physical findings in a newborn suffering from Fetal alcohol syndrome. *(p 615)*

_____

_____

3. What symptoms might a newborn suffering from neonatal abstinence syndrome display? *(p 615)*

_____

_____

4. What two structures does the urachus connect? What two structures does the vitelline duct connect? What are the clinical consequences of either of these ducts failing to close? *(p 618)*

_____

_____

_____

5. Describe the genetic signal that directs differentiation along the male pathway rather than the female (default) pathway, naming specific cell types and factors. *(p 622)* _____

_____

_____

_____

ANATOMY

6. Describe the venous drainage flow from the left ovary/testicle. Describe the venous drainage flow from the right ovary/testicle. To which lymph nodes do these structures drain? *(p 624)*

_____

_____

7. On which side are varicoceles more common and why? *(p 624)* _____

_____

8. Match the female reproductive system ligament to the structures it connects. *(p 625)*

_____ A. Connects cervix to side wall of pelvis
_____ B. Connects ovaries to lateral pelvic wall
_____ C. Connects medial pole of ovary to uterine horn
_____ D. Connects uterine horn to labia majora
_____ E. Connects uterus, fallopian tubes, and ovaries to pelvic side wall

1. Broad ligament
2. Cardinal (transverse cervical) ligament
3. Ovarian ligament
4. Round ligament
5. Infundibulopelvic ligament

9. A female patient presents with acute pelvic pain, adnexal mass, and nausea/vomiting. What does she likely have? *(p 625)* _____

_____

10. What pathway do sperm follow during ejaculation? *(p 626)* _____

_____

11. Why aren't gametes attacked by a man's immune system? *(p 628)* _____

_____

12. Which cells in the male reproductive tract secrete inhibin B? Which secrete testosterone? *(p 628)*

_____

PHYSIOLOGY

13. What are the three major forms of estrogen? How do they compare in potency? *(p 630)* _____

_____

14. What are the three major sources of estrogens? *(p 630)* _____

_____

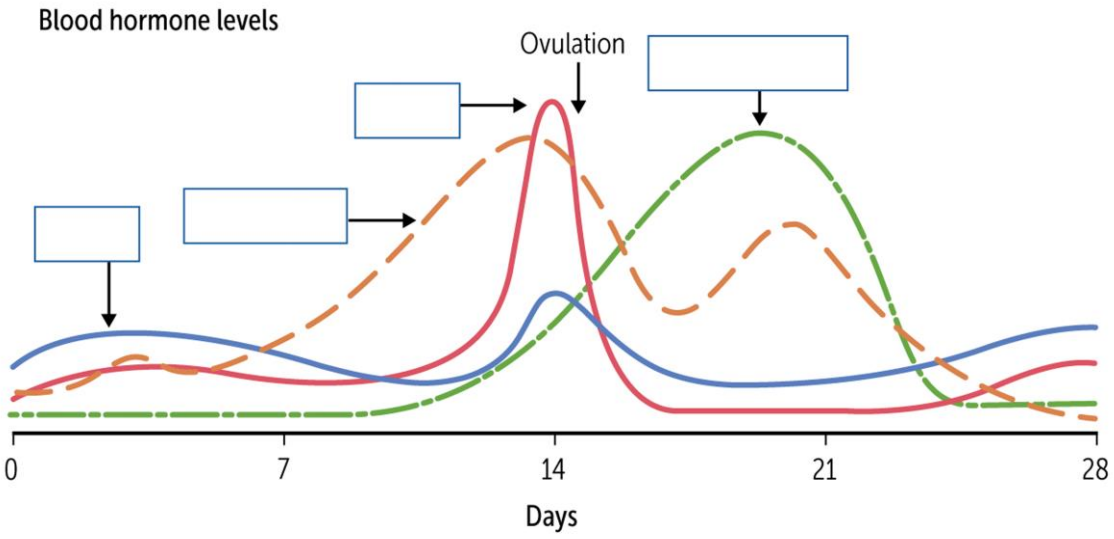
15. Which estrogen is used as an indicator of fetal well-being? *(p 630)* _____

16. List the four functions of estrogen. *(p 630)* _____

_____

_____

17. Identify the hormone levels shown on the image. *(p 632)*



18. What are the structural and non-structural causes of abnormal uterine bleeding? *(p 633)* _____

_____

_____

19. Where is hCG synthesized? When is hCG first detectable in the blood? In the urine? *(p 633)*

_____

_____

20. In what pathologic states can hCG levels be elevated? *(p 633)* _____

_____

21. What cells synthesize HPL and what is its main function? *(p 634)* _____

_____

22. A newborn with pink arms and torso, irregular respirations, pulse of 64, no movement and weakly crying has an APGAR score of? *(p 634)* _____

23. Describe the benefits of breastfeeding for the newborn and the mother. *(p 636)* _____

_____

_____

24. What hormonal changes occur during menopause? *(p 636)* _____

_____

25. What are the sequelae of menopause? *(p 636)* _____

_____

26. What are the three major forms of androgens? How do they compare in potency? *(p 636)* _____

_____

27. List the five functions of testosterone. *(p 636)* _____

_____

_____

28. Compare the causes of central vs. peripheral precocious puberty. *(p 637)* _____

_____

_____

PATHOLOGY

29. Klinefelter syndrome is associated with which karyotype? What are the clinical findings? *(p 638)*

_____

30. Turner syndrome is associated with which karyotype? What are the clinical findings? *(p 638)* ____

_____

_____

31. For each diagnosis below, indicate whether the lab findings are elevated, decreased, or normal. *(p 639)*

Diagnosis	LH	Testosterone
Defective androgen receptor		
Hypogonadotropic hypogonadism		
Hypergonadotropic hypogonadism		
Testosterone-secreting tumor or exogenous steroids		

32. Define the following terms and list the risk factors. *(p 640)*

A. Abruptio placentae _____

_____

B. Placenta accreta _____

_____

C. Placenta increta _____

_____

D. Placenta percreta _____

_____

E. Placenta previa _____

_____

33. What are the most common risk factors for ectopic pregnancy? *(p 641)* _____

_____

34. Match these gynecologic conditions with their associated findings. *(pp 641-642, 645-648)*

_____ A. Dysplasia and carcinoma in situ	1. Too little amniotic fluid
_____ B. Choriocarcinoma	2. Too much amniotic fluid
_____ C. Dysgerminoma	3. Call-Exner bodies
_____ D. Endometriosis	4. Chocolate cysts
_____ E. Granulosa cell tumor	5. Dermoid cyst
_____ F. Fibromas	6. HPV-16 and HPV-18
_____ G. Mature cystic teratoma	7. AFP tumor marker
_____ H. Oligohydramnios	8. CA 125 levels
_____ I. Ovarian neoplasms	9. Increased hCG level
_____ J. Polyhydramnios	10. hCG and LDH tumor markers
_____ K. Yolk sac tumor	11. Meigs syndrome

35. What are the risk factors for preeclampsia/eclampsia? *(p 643)* _____

_____

36. What is HELLP syndrome? *(p 643)* _____

_____

37. Rank the incidence of gynecologic tumors in the United States from most common to least common: cervical, endometrial, and ovarian. Then rank the prognosis of these tumors from worst to best. *(p 643)* _____

_____

38. A 68-year-old female patient presents with porcelain-white plaques on her vulva with a red border. What is her most likely diagnosis, and what disease could follow in later years? *(p 644)* _____

_____

39. If left untreated, what can imperforate hymen lead to? *(p 644)* _____

_____

40. Which condition is associated with eating disorders and “female athlete triad”? *(p 645)*

_____

41. What hormonal changes occur in polycystic ovarian syndrome? *(p 645)* _____

_____

42. What symptoms does primary dysmenorrhea cause and how is it treated? *(p 645)*

_____

43. Match these breast tumors with their associated diagnostic findings. *(pp 649-650)*

_____ A. Ductal carcinoma in situ	1. Often bilateral
_____ B. Fibroadenoma	2. Ductal atypia
_____ C. Inflammatory carcinoma	3. Eczematous patches over nipple, areola
_____ D. Intraductal papilloma	4. Hard mass with sharp margins
_____ E. Invasive ductal carcinoma	5. Increased tenderness prior to menstruation
_____ F. Invasive lobular carcinoma	6. Nipple discharge; benign
_____ G. Paget disease of breast	7. Peau d'orange

44. Match these testicular conditions with their associated diagnostic findings. *(pp 651-653)*

_____ A. Acquired hydrocele	1. Androblastoma
_____ B. Choriocarcinoma	2. Associated with lack of circumcision
_____ C. Leydig cell tumor	3. Dilated epididymal duct
_____ D. Seminoma	4. Dilated vein in pampiniform plexus
_____ E. Sertoli cell tumor	5. Increased scrotal fluid
_____ F. Spermatocele	6. Increased hCG level
_____ G. Squamous cell carcinoma	7. Most common testicular tumor
_____ H. Testicular lymphoma	8. Most common testicular tumor in older men
_____ I. Varicocele	9. Reinke crystals
_____ J. Yolk sac tumor	10. Schiller-Duval bodies

45. What hormone levels are elevated in choriocarcinomas? In teratomas? *(p 653)* _____

_____

46. What are the differences between epididymitis and orchitis? How do they each present? *(p 654)*

_____

_____

47. Which lobes are affected in benign prostatic hyperplasia compared to prostatic adenocarcinoma? *(p 654)* _____

_____

48. How are most prostate cancers diagnosed? *(p 654)* _____

PHARMACOLOGY

49. Continuous leuprolide has _____ (agonist/antagonist) properties, whereas pulsatile leuprolide has _____ (agonist/antagonist) properties. *(p 656)*

50. What is the clinical use for Degarelix? What are the adverse effects? *(p 656)* _____

_____

51. How does clomiphene stimulate ovulation? *(p 656)* _____

_____

52. What is the main clinical use of Tamoxifen? *(p 656)* _____

53. How does Raloxifene differ from Tamoxifen? *(p 656)* _____

_____

_____

54. How do oral contraceptive pills prevent pregnancy? *(p 657)* _____

_____

55. In which patients are oral contraceptive pills contraindicated? *(p 657)* _____

_____

_____

56. What drugs are commonly used to treat BPH? *(p 658)* _____

_____

57. Name a medication that can be used for male-pattern baldness. What is its MOA? *(p 658)* _____

_____

Answers

EMBRYOLOGY

1.

Embryologic Derivative	Ectoderm	Mesoderm	Endoderm
Adenohypophysis	√		
Muscle		√	
Gut tube epithelium			√
Brain	√		
Wall of gut tube		√	
PNS ganglia	√		
Most of the urethra and lower vagina			√
Bone		√	
Kidneys		√	
Oligodendrocytes	√		
Spleen		√	
Parathyroid			√

2. Pre- and postnatal developmental retardation, microcephaly, facial abnormalities (eg, smooth philtrum, thin vermillion border, small palpebral fissures), limb dislocation, and heart defects.

3. Uncoordinated sucking reflexes, irritability, high-pitched crying, tremors, tachypnea, sneezing, diarrhea, and possibly seizures.

4. The urachus connects the fetal bladder and the umbilicus; the vitelline duct connects the yolk sac to the midgut lumen. Patent urachus leads to urine discharge from the umbilicus, and a vitelline fistula leads to meconium discharge from the umbilicus.

5. The *SRY* gene on the Y chromosome produces testis-determining factor, which leads to development of testes. Within the testes, Sertoli cells secrete Müllerian inhibitory factor, suppressing development of the paramesonephric ducts (which develop into female reproductive structures), and Leydig cells secrete androgens that stimulate development of the mesonephric ducts (which develop into male internal structures).

ANATOMY

6. Left ovary/testis → left gonadal vein → left renal vein → inferior vena cava (IVC). Right ovary/testis → right gonadal vein → IVC. The ovaries/testes drain to the para-aortic lymph nodes.

7. Left side. Because of the right angle created at the left gonadal-renal vein junction, there is an increase of high resistance flow, which can lead to backup. Enough backup leads to blood pooling in the left gonadal veins.

8. A-2, B-5, C-3, D-4, E-1.

9. Adnexal torsion - twisting of the ovary and fallopian tube around infundibulopelvic ligament and ovarian ligament, causing compression of ovarian vessels in infundibulopelvic ligament, leading to blockage of lymphatic and venous outflow.

10. Remember **SEVEN-UP**: **S**eminiferous tubules → **E**pididymis → **V**as deferens → **E**jaculatory ducts → (**N**othing) → **U**rethra → **P**enis.

11. Tight junctions between adjacent Sertoli cells form a blood-testis barrier that isolate gametes from autoimmune attack.

12. Inhibin B: Sertoli cells. Testosterone: Leydig cells.

PHYSIOLOGY

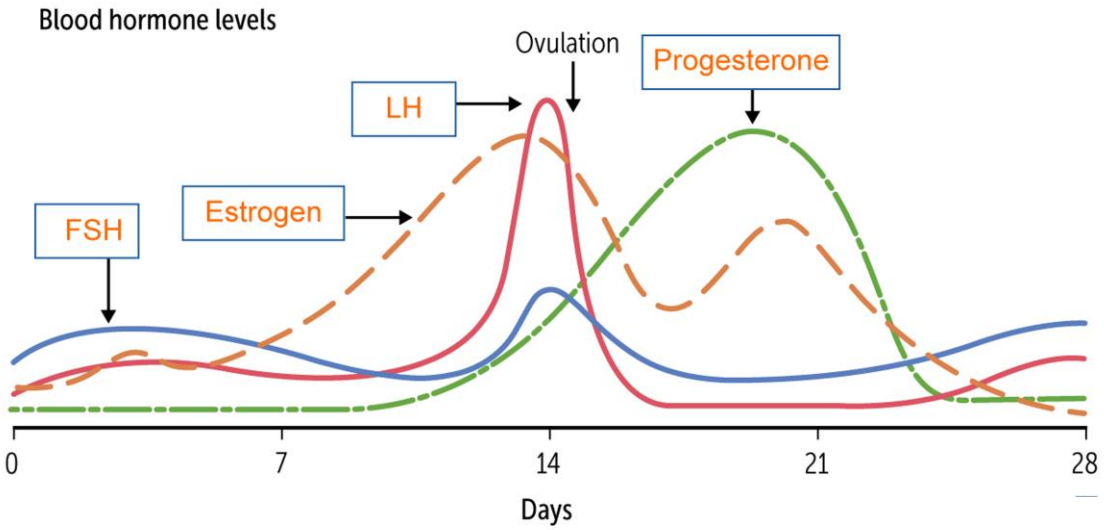
13. Estradiol, estrone, and estriol. Estradiol is more potent than estrone, which is more potent than estriol (estradiol > estrone > estriol).

14. Ovary (17β-estradiol), placenta (estriol), and adipose tissue (estrone via aromatization).

15. Estriol is used as a marker of fetal well-being.

16. Development of genitalia and breast, female fat distribution; growth of follicle, endometrial proliferation, increased myometrial excitability; upregulation of estrogen, luteinizing hormone (LH), and progesterone receptors and feedback inhibition of FSH and LH, then LH surge; stimulation of prolactin secretion; and increased transport of proteins, SHBG; ↑ HDL; ↓ LDL.

17.



18. Structural causes (**PALM**): **P**olyp, **A**denomyosis, **L**eiomyoma, or **M**alignancy/hyperplasia. Non-structural causes (**COEIN**): **C**oagulopathy, **O**vulatory, **E**ndometrial, **I**atrogenic, **N**ot yet classified. Remember **PALM-COEIN**.

19. In syncytiotrophoblasts of the placenta; 1 week after conception (in blood); 2 weeks after conception (in urine).

20. hCG levels can be elevated in multiple gestations, hydatidiform moles, choriocarcinomas, and Down syndrome.

21. HPL is synthesized by the syncytiotrophoblasts of the placenta, and functions to stimulate insulin production as well as increase overall insulin resistance in an effort to shunt nutrients across the placenta to the developing fetus.

22. APGAR score: 5.

23. Breast milk is the ideal nutrition for infants up to 6 months old. It contains immunoglobulins, which confer passive immunity to the baby, macrophages, and lymphocytes. Breast milk reduces infant infections and is associated with decreased risk for the child to develop asthma, allergies, diabetes mellitus, and obesity. In the mother, it decreases the risk of breast and ovarian cancers and facilitates mother-child bonding.

24. Decreased estrogen and increased FSH, LH, and GnRH levels.

25. Remember: **HAVOCS**: **H**ot flashes, **A**trophy of **V**agina, **O**steoporosis, and **C**oronary artery disease, **S**leep disturbances.

26. Testosterone, dihydrotestosterone (DHT), and androstenedione. DHT is more potent than testosterone, which is more potent than androstenedione (DHT > testosterone > androstenedione).

27. Differentiation of the epididymis, vas deferens, and seminal vesicles (internal genitalia, except prostate); growth spurts: penis, seminal vesicles, sperm, muscle, RBCs; deepening of the voice, closing of the epiphyseal plates, and libido.

28. Central precocious puberty results from an early activation of the HPG-axis from an increase in GnRH secretion, such as from a CNS tumor. Peripheral precocious puberty occurs due to increased sex hormone production or exposure, such as congenital adrenal hyperplasia, estrogen-secreting ovarian tumor (eg, granulosa cell tumors), Leydig cell tumors, or McCune-Albright syndrome.

PATHOLOGY

29. 47, XXY; testicular atrophy, eunuchoid body shape, tall stature, long extremities, gynecomastia, and female hair distribution. May present with developmental delay.

30. 45, XO; short stature (preventable with growth hormone therapy), ovarian dysgenesis, shield chest, lymphatic defects (resulting in webbed neck or cystic hygroma), bicuspid aortic valve, coarctation of the aorta, horseshoe kidney, high-arched palate, shortened 4th metacarpals, and primary amenorrhea.

31.

Diagnosis	LH	Testosterone
Defective androgen receptor	↑	↑
Hypogonadotropic hypogonadism (2°)	↓	↓
Hypergonadotropic hypogonadism (1°)	↑	↓
Testosterone-secreting tumor or exogenous steroids	↓	↑

32. A. Abruptio placentae: premature separation (partial or complete) of placenta from uterine wall before delivery of infant. Risk factors include trauma, smoking, hypertension, preeclampsia, and cocaine abuse.

    B. Placenta accreta: defective decidual layer leads to abnormal attachment to myometrium without penetrating it, and separation after delivery. Risk factors include prior C-section or uterine surgery involving myometrium, inflammation, placenta previa, advanced maternal age, and multiparity.

    C. Placenta increta: placenta penetrates into the myometrium. Same risk factors as for placenta accreta.

    D. Placenta percreta: placenta penetrates ("perforates") through myometrium into surrounding uterine serosa (invades entire uterine wall); can result in placental attachment to rectum or bladder. Same risk factors as for placenta accreta and increta.

    E. Placenta previa: attachment of placenta over internal cervical os. Risk factors include multiparity and prior C-section. (Low-lying placenta (< 2 cm from internal cervical os) is managed differently from placenta previa.)

33. Prior ectopic pregnancy, history of infertility, salpingitis (pelvic inflammatory disease), ruptured appendix, prior tubal surgery, smoking, and advanced maternal age.

34. A-6, B-9, C-10, D-4, E-3, F-11, G-5, H-1, I-8, J-2, K-7.

35. Preexisting hypertension, diabetes, chronic kidney disease, autoimmune disorders, maternal age > 40 years.

36. **HELLP: H**emolysis, **E**levated **L**iver enzymes, **L**ow **P**latelets. A manifestation of severe preeclampsia.

37. For incidence: endometrial > ovarian > cervical. For prognosis: ovarian (worst) > endometrial > cervical (best).

38. Lichen sclerosus; squamous cell carcinoma (SCC).

39. Primary amenorrhea, cyclic abdominal pain, hematocolpos (accumulation of menstrual blood in vagina, leading to bulging and bluish hymenal membrane).

40. Functional hypothalamic amenorrhea.

41. ↑ LH:FSH ratio, ↑ androgens (eg, testosterone).

42. Painful menses, caused by uterine contractions. Treatment: NSAIDs.

43. A-2, B-5, C-7, D-6, E-4, F-1, G-3.

44. A-5, B-6, C-9, D-7, E-1, F-3, G-2, H-8, I-4, J-10.

45. Choriocarcinomas typically present with an increase in beta-hCG, while teratomas normally do not present with an elevation in any of the typical germ cell tumor markers (beta-hCG, PALP, and AFP).

46. Epididymitis is the inflammation of the epididymis. Presents with localized pain and tenderness over posterior testis. Orchitis is the inflammation of testis. Presents with testicular pain and swelling.

47. In BPH, the periurethral lobes enlarge to compress the urethra into a vertical slit. Prostatic adenocarcinoma occurs most commonly in the posterior lobe of the prostate gland.

48. Increased PSA and subsequent needle core biopsy.

PHARMACOLOGY

49. Antagonist; agonist.

50. To treat prostate cancer. It can cause hot flashes and liver toxicity.

51. By preventing normal feedback inhibition and increasing LH and FSH release from the pituitary.

52. To treat and prevent recurrence of estrogen receptor–positive ER/PR ⊕ breast cancer.

53. While both tamoxifen and raloxifene are antagonists at the breast and agonists at the bones, only tamoxifen is an agonist at the uterus, which can increase a patient's risk for endometrial cancer. Because of this, raloxifene is more commonly used to treat osteoporosis. Both can cause an increase in thromboembolic events.

54. OCPs prevent the estrogen surge, which in turn prevents the LH surge, and thus ovulation.

55. Smokers >35 years old, patients with a high risk of cardiovascular disease (including history of venous thromboembolism, coronary artery disease, and stroke), and those with a history of migraines (especially with aura), breast cancer, or liver disease.

56. Finasteride, tamsulosin, terazosin, and tadalafil.

57. Minoxidil. Potassium channel opener that leads to arteriole vasodilation.